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16. e.

PROCEEDINGS

OF THE

GENERAL MEETINGS FOR SCIENTIFIC BUSINESS

OF THE

ZOOLOGICAL SOCIETY

OF LONDON,

FOR THE YEAR

1895.

PART I.

CONTAINING PAPERS READ IN

JANUARY AND FEBRUARY.

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Z D
NATURAL HISTORY

JUNE 1st, 1895.

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1895.

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5 MAY 1936

PROCEEDINGS

OF THE

GENERAL MEETINGS FOR SCIENTIFIC BUSINESS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.

BRITISH MUSEUM NATURAL HISTORY

January 15, 1895.

Dr. St. George Mivart, F.R.S., Vice-President, in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of December 1894:—

The total number of registered additions to the Society's Menagerie during the month of December was 55, of which 34 were by presentation, 1 by exchange, 12 by purchase, and 8 received on deposit. The total number of departures during the same period, by death and removals, was 109.

Mr. Sclater called attention to the two Tapirs deposited in the Gardens by the Hon. W. Rothschild, F.Z.S., the female on July 12th, 1893, and the male on Sept. 2, 1893, both entered in the Register as *Tapirus americanus*. On further examination Mr. Sclater had come to the conclusion that these animals were probably referable to Dow's Tapir (*Tapirus dowi*), of Central America, of which an excellent coloured figure had been given in Godman and Salvin's 'Biologia Centrali-Americana,' Mammals, pl. ix. p. 104.

Mr. P. Chalmers Mitchell, F.Z.S., exhibited and gave an account of a tibia and other bones of an extinct bird of the genus *Æpyornis* from Central Madagascar, which had been lent to him for exhibition by Mr. Joseph H. Fenn. With these bones was associated a skull of a species of *Hippopotamus*.

Professor G. B. Howes exhibited a photograph of an embryo of a Platypus (*Ornithorhynchus anatinus*) received from his former pupil Mr. J. P. Hill, Demonstrator of Biology in the University of Sydney. It illustrated a paper recently read by Messrs. Hill and C. J. Martin before the Linnean Society of New South Wales[1]. The embyro had been obtained from one of two eggs "just ready to be laid," which Messrs. Hill and Martin collected during a recent holiday-expedition in Australia. The eggs measured each 18 mm. by 13·5 mm., and were somewhat larger than those described by Caldwell. Prof. Howes briefly recapitulated the circumstances of the Caldwell and Semon Australian expeditions, and remarked that the same post brought him the photograph exhibited and an author's copy of Prof. Semon's first monograph[2] on the development of the Monotremata and Marsupialia, which he laid upon the table. He commented upon the high artistic merit of the photograph, and briefly recapitulated the facts which Messrs. Hill and Martin had already recorded from the study of the object itself. He pointed out that the stage in development which the former depicted was intermediate between those thus far described by Semon, and that therefore the facts which it revealed were novel; and remarked that he brought it forward in testimony to the assertion that our countrymen at the Antipodes are doing their best, as opportunity occurs, to protect us against the slur which is being cast upon us, in connexion with the well-known circumstances to which he had sufficiently alluded. Criticising the photograph, he drew attention to the appearances presented by the myelomeres (somatic neuromeres) as compared with the encephalomeres (cephalic neuromeres), regarded by McClure as homologous sets of structures. The appearances which the myelomeres presented (unless indicative of mere cell-differentiation and localization during development) seemed to him to suggest that they might be compound structures, and that in each 'myelomere' we might be dealing with a product of union of neuromeres of the encephalomeric order, and to therefore raise a question of manifest interest, in its bearings upon the metamerism of the vertebrate body, and upon the recent conclusions of Orr, McClure[3], and others concerning the segmental value of the brain and head region.

The Secretary exhibited, on behalf of Mr. R. Lydekker, F.Z.S., a life-sized drawing of *Idiurus zenkeri*, a new and remarkably small form of Flying Squirrel from West Africa, recently described by Herr Matschie (Sitz.-B. Ges. nat. Freunde, Berlin, 1894, p. 197).

The Secretary, on behalf of Lord Lilford, F.Z.S., exhibited the skin of a Duck, believed to be a hybrid between the Mallard (*Anas*

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[1] *Cf.* Proc. Linn. Soc. N. S. W., Nov. 28, 1894, p. ii.

[2] "Zool. Forschungsreisen in Austr. u. d. Malay. Archipel" (Denkschr. d. Med. Naturwiss. Gesellsch. Jena, Bd. v. p. 3).

[3] *Cf.* McClure, Anat. Anzeiger, Bd. xii. p. 435, and Journ. Morph. vol. iv. p. 35.

boschas) and the Teal (*Querquedula crecca*), that had been caught in a decoy in Northamptonshire, and read the following remarks:—

"The skin sent up for exhibition was taken from a bird that dropped on to our decoy-pool near Tichmarsh, Norths., with a small bunch of Teal, at morning flight-time on December 21st, 1894, and was taken with six of the last-named species and six Mallard soon after daylight. I very much regret that the decoy-man did not distinguish its difference from the other 'fowl' captured with it till after he had killed it. This specimen is without doubt in my opinion a hybrid between Teal and Mallard, and equally certainly belongs to the race to which Pennant gave the name of 'Bimaculated Duck' (British Zoology, vol. ii. 8vo ed. 1776, p. 602, pl. C). Professor A. Newton, to whom I wrote for further information on the subject of this 'Bimaculated Duck,' has most kindly and promptly supplied me with the following details:—'In his 'Arctic Zoology' (1785) Pennant remarks (ii. p. 575), 'My Bimaculated Duck (Br. Zool.) has been discovered by Doctor Pallas along the *Lena* and about Lake *Baikal*, and a description sent by him to the Royal Academy at Stockholm under the title of *Anas glocitans*, or the Clucking Duck, from its singular note.' This erroneous identification was accepted, as you know, for a long while; Keyserling and Blasius, in 1840, seem to have been the first to perceive it (Wirbelth. Europ. p. lxxxv). They accordingly named Pennant's bird *A. bimaculata*, without expressing any suspicion of its being a hybrid, nor did such suspicion arise, so far as I know, until a good many years after,—for I think I remember Yarrell talking of it as an open question. However in 1856 he had become convinced of the bird being a hybrid, and omitted it from his 3rd edition published in that year, for by that time specimens of the true *A. glocitans* had been received in England.'

"I find that in my first reference to Pennant I have omitted to state that after his description of the bird, *loc. supra cit.*, he writes:—'Taken in a decoy near   in 1771; communicated to me by   Poore, Esq.' Professor Newton tells me that the blanks are in the original, and at the end of his notes to me adds:—'A. and H. Matthews, in their List of the Birds of Oxfordshire (Zool. p. 2539), say that they suppose the decoy at which the bird of 1771 was taken was that at Boarstall near Otmoor.' Yarrell, in the second edition of his 'British Birds,' 1845 (vol. iii. p. 260), supplies the Christian name of Pennant's correspondent as 'Edward,' and after an allusion to Pallas says that no further account has reached us of the specimen alluded to, nor has it been ascertained whether it was preserved. Yarrell goes on to say, *loc. supra cit.*:—'The specimens of both male and female, from which I have taken the description, were sent up from a decoy near Maldon, in Essex, to Leadenhall Market, in the winter of 1812–13. Here they were observed by a respectable naturalist, Mr. George Weighton, of Fountain Place, City-road, who immediately purchased them and set them up. From his collection they have subsequently passed into mine. There can be little doubt of the two birds being sexes of the same species.' I may add that the present specimen is the only one of this hybrid that I have ever handled, or, to the best of my recollection, ever seen."

The Rev. T. R. R. Stebbing exhibited a specimen of a species of *Peripatus* from Antigua.

The following papers were read:—

1. On some Foraminifera obtained by the Royal Indian Marine Survey's S.S. 'Investigator,' from the Arabian Sea, near the Laccadive Islands. By Frederick Chapman, F.R.M.S.

[Received November 7, 1894.]

(Plate I.)

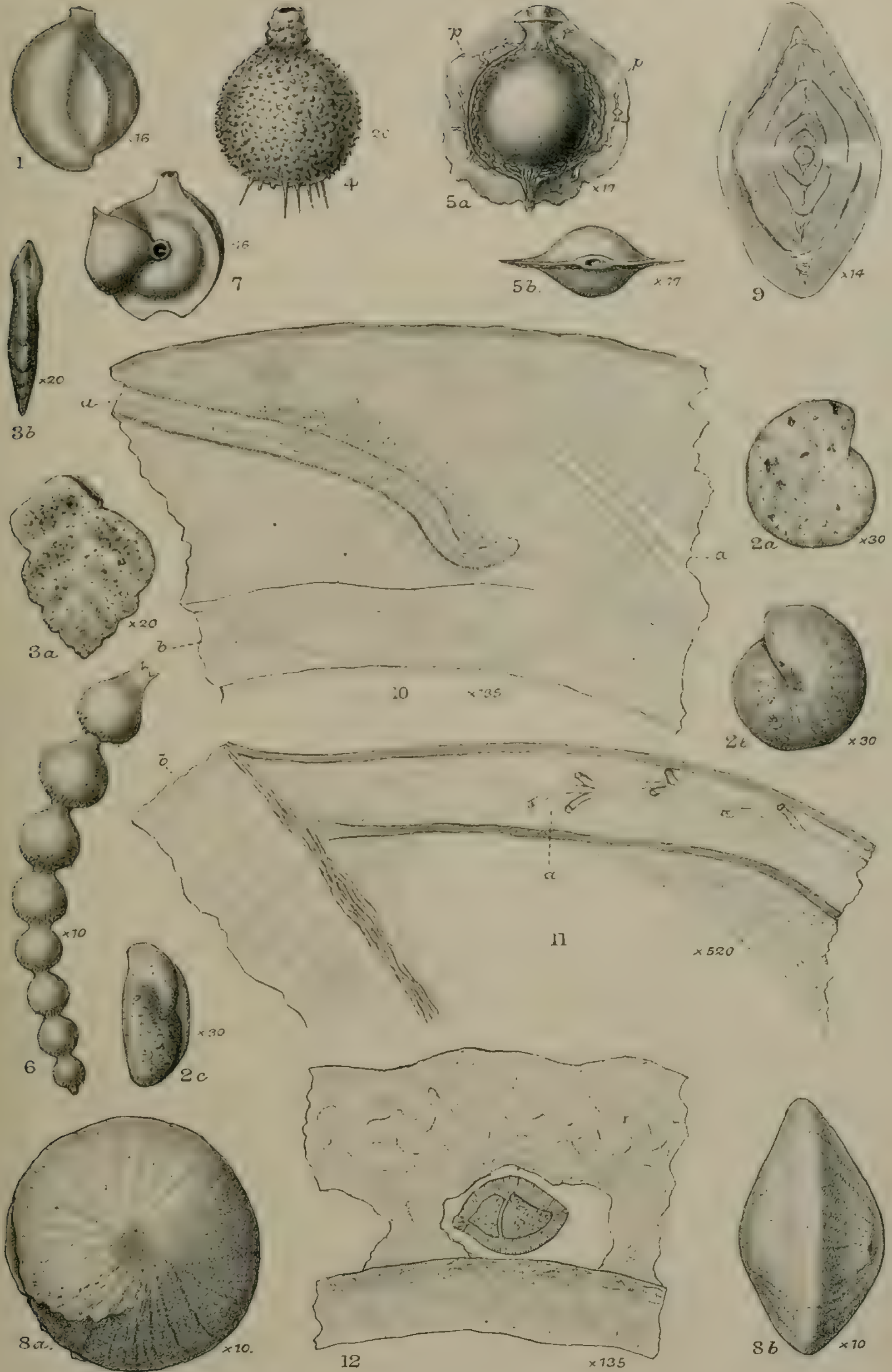
On the 25th of July, 1893, I received some samples of deep-sea soundings from Mr. T. H. Holland, F.G.S., Assistant-Superintendent of the Geological Survey of India, who, in conjunction with Dr. Alcock, Surgeon-Naturalist in the Royal Indian Marine Survey Department, has very kindly placed the material in my hands for description.

The results of a somewhat exhaustive examination of the soundings appear to be of sufficient interest for publication. Moreover, the locality from whence these soundings were obtained is sufficiently out of the path of former expeditions to make the list useful. The soundings were obtained by the Royal Indian Marine Survey's steamship 'Investigator' from a limited area near the Lakadivh (Laccadive) Islands, viz., 15° 30′ 4″ to 8° 21′ 3″ N. lat. and 75° 42′ 5″ to 71° 09′ 3″ E. long.

The depths at which the soundings were obtained have not been recorded, but they did not exceed 1238 fathoms. This absence of the record of depths is explained by the fact that the material was originally sent to Mr. Holland for his opinion regarding the supposed occurrence of submarine volcanoes in that part of the Arabian Sea, the search for Foraminifera being undertaken subsequently. Samples of the soundings were sent to me after having been washed for the purpose just stated.

Mr. Holland has also kindly furnished me with the following notes concerning the temperature of the area from whence the material was taken.—"The lowest bottom temperature recorded was 37° F., several times at about 1130 fathoms; the surface temperature being about 78°–80° F."

The material was sent in six bottles, each sample appearing to represent a mixture of several distinct soundings. The samples are labelled thus:—



F.Chapman del.ad nat.
E.C.Knight lith.

West,Newman imp.

Foraminifera from the Arabian Sea.

BRITISH MUSEUM
2 S D
NATURAL HISTORY.

Sample No. 1.

Nos. 1–4, 6–9, 10, 14, 15–18, 19, 20, 22, 26, 49, 50–54, 58, 59.
"*Globigerina* ooze. Terrigenous deposit. *Globigerina* ooze. Green mud. *Globigerina* ooze."

Sample No. 2.

Nos. 11, 23, 55.
"Green mud. Broken coral. S. crl. (= (?) Sandy mud with coral). Broken coral."

Sample No. 3.

Nos. 23–25, 28–30, 62.
"Green ooze."

Sample No. 4.

Nos. 27, 32, 34, 35, 38–44, 57, 60.
"Grey ooze."

Sample No. 5.

Nos. 31, 45–48.
"Brown ooze."

Sample No. 6.

Nos. 47–53.
"Brown ooze. *Globigerina* ooze."

The washed soundings, as received, consisted of, in each case, a nearly pure assemblage of foraminiferal shells; with the exception of Sample No. 2, which was composed mainly of coral detritus with some Foraminifera.

The other organisms noticed in the material during the search for Foraminifera were the following.—

Sample No. 1.

Ostracoda.—*Pontocypris* (?) *subreniformis*, G. S. Brady.
Macrocypris tenuicauda, G. S. B.
Bairdia attenuata, G. S. B.
—— *hirsuta*, G. S. B.
Cytherella polita, G. S. B.
Also Radiolaria of 3 species.

Sample No. 3.

Ostracoda.—*Cythere dictyon*, G. S. B.

Sample No. 4.

Some fish otoliths.
Pteropoda.—*Clio* (*Styliola*) *subula* (Quoy & Gaimard) and *Cavolinia uncinata* (Rang).
Ostracoda.—*Bairdia hirsuta*, G. S. B.
Cythere dictyon, G. S. B.
—— *acanthoderma*, G. S. B.
—— (?) *serrulata*, G. S. B.
Cytherella polita, G. S. B.

Sample No. 5.

Ostracoda.—*Pontocypris faba*? (Reuss).
Cythere (?) *serratula*, G. S. B.
Krithe hyalina, G. S. B.
Xestoleberis expansa, G. S. B.
Pseudocythere caudata, G. O. Sars.

Also Radiolaria of 6 species.

Sample No. 6.

Ostracoda.—*Pontocypris faba*? (Reuss).
Macrocypris decora, G. S. B.
Bairdia foveolata, G. S. B.
—— *minima*, G. S. B.
—— *hirsuta*, G. S. B.
Cythere (?) *serratula*, G. S. B.
Cythere dictyon, G. S. B.
—— *radula*, G. S. B.
Krithe hyalina, G. S. B.
—— *producta*, G. S. B.
Cytherella polita, G. S. B.

A striking feature of the foraminiferal fauna of the Arabian Sea is the presence therein of a number of forms which have already been described by Dr. Conrad Schwager[1] from marine clay-beds, of late Pliocene age, on the northern coast of Kar Nicobar[2].

Although many of the species recorded from those fossil beds were subsequently found by Dr. Brady in the 'Challenger' soundings, yet there still remained at least five well-defined forms recorded by Dr. Schwager from the above-mentioned Pliocene beds, and these are noted here for the first time as recent Foraminifera.

There are altogether eight species new to the list of recent Foraminifera, but which have formerly been recorded as fossils: these are:—*Textularia lythostrotum* (Schwager), *Cassidulina murrhina* (Schwager), *Lagena capillosa* (Schwager), *Nodosaria* (*Dentalina*) *adolphina* (d'Orb.), *Nodosaria ovulata*, Sherb. & Chap., *Nodosaria* (*D.*) *acicula*, Lam., *Polymorphina fusiformis* (Römer), and *Calcarina nicobarensis*, Schwager.

Besides these there are two new species and three new varieties.

A list of Foraminifera obtained from the Bay of Bengal by H.M.S. 'Investigator' (from lat. 17° 34′ N., long. 87° 59′ E.) is given by Dr. John Murray in the 'Scottish Geographical Magazine' for August 1889. The material examined was a blue mud, obtained at a depth of 1300 fathoms. Amongst the thirty-seven species therein enumerated there are, however, no Tertiary species such as were obtained from the Arabian-Sea deposits.

In concluding these preliminary remarks it only remains for me to express my deep obligations to Professor T. Rupert Jones, F.R.S., for his kind help and advice during the writing of this paper.

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[1] "Fossile Foraminiferen von Kar-Nicobar." Novara-Exped., geol. Theil, vol. ii. 1866, p. 187. 4to, Wien.

[2] F. von Hochstetter, *op. cit.* p. 88.

In the following detailed account of the species, references are made chiefly to the monograph of Dr. H. B. Brady, since it is a standard and easily accessible work.

FORAMINIFERA.

NUBECULARIA, Defrance.

1. NUBECULARIA LUCIFUGA, Defrance.

Nubecularia lucifuga, Brady, 1884, Chall. Rep. vol. ix. p. 134, pl. i. figs. 9–16.

A single specimen of this species occurred in Sample No. 1.

BILOCULINA, d'Orbigny.

2. BILOCULINA DEPRESSA, d'Orbigny.

Biloculina depressa, Brady, 1884, Chall. Rep. vol. ix. p. 145, pl. ii. figs. 12, 15–17, pl. iii. figs. 1, 2.

This species attains a great size in these deposits, many of the specimens being as large as $\frac{1}{10}$ inch in diameter, measured across the face. Common in Sample No. 1; frequent, No. 3; common, No. 4; rare, No. 5; frequent, No. 6.

3. BILOCULINA DEPRESSA, d'Orb., var. MURRHYNA, Schwager.

Biloculina murrhyna, Schwager, 1866, Novara-Exped., geol. Theil, vol. ii. p. 203, pl. iv. fig. 15 *a–c*.

B. depressa, var. *murrhyna*, Brady, 1884, Chall. Rep. vol. ix. p. 146, pl. ii. figs. 10, 11; Schlumberger, 1885, Bull. Soc. Géol. France, sér. 3, vol. xiii. p. 238, figs. 9, 10, p. 290, figs. 15, 16; Schlumberger, 1891, Mém. Soc. Zool. France, vol. iv. p. 552, pl. ix. figs. 52–54.

This deep-water form has been recorded from the Atlantic and Pacific Oceans from depths between 1180 and 1900 fathoms (Brady). It was also found fossil in the Island of Kar Nicobar (Schwager).

Frequent in Sample No. 1; frequent, No. 4; rare, No. 6.

4. BILOCULINA DEPRESSA, d'Orb., var. SERRATA, Brady.

Biloculina depressa, var. *serrata*, Brady, 1884, Chall. Rep. vol. ix. p. 146, pl. iii. fig. 3 *a–c*.

This, another deep-water form, is rare in these deposits in Sample No. 1; very rare, No. 3; rare, No. 6.

5. BILOCULINA TUBULOSA, Costa. (Plate I. figs. 1, 7.)

Biloculina tubulosa, Brady, 1884, Chall. Rep. vol. ix. p. 147, pl. iii. fig. 6 *a–c*.

This species has before been found off Kandavu, Fiji Islands, at 210 fathoms (Brady).

An abnormal variety of this species was found in Sample No. 1 (see Pl. I. fig. 7), in which the last two chambers have been twisted; and both possess characteristic tubular apertures, so that the specimen has the appearance of two forms intergrown at right angles to one another.

This species is frequent in Sample No. 1; rare, No. 3; common, No. 4; very rare, No. 5; frequent, No. 6.

6. BILOCULINA RINGENS (Lamarck).

Biloculina ringens, Brady, 1884, Chall. Rep. vol. ix. p. 142, pl. ii. figs. 7, 8.

This form occurs very rarely in Sample No. 6.

7. BILOCULINA RINGENS (Lam.), var. STRIOLATA, Brady.

Biloculina ringens, var. *striolata*, Brady, 1884, Chall. Rep. vol. ix. p. 143, pl. iii. figs. 7, 8.

Previously found in the Pacific from depths of from 6 to 8 fathoms (Brady).

Very rare in Sample No. 3; very rare, No. 4; rare, No. 6.

8. BILOCULINA COMATA, Brady.

Biloculina comata, Brady, 1884, Chall. Rep. vol. ix. p. 144, pl. iii. fig. 9 *a*, *b*.

This species occurs very rarely in Sample No. 6.

SPIROLOCULINA, d'Orbigny.

9. SPIROLOCULINA ROBUSTA, Brady.

Spiroloculina robusta, Brady, 1884, Chall. Rep. vol. ix. p. 150. pl. ix. figs. 7, 8.

This species was described by Dr. Brady from specimens found off Culebra Island, West Indies, 390 fathoms.

Typical examples of *S. robusta* were frequent in Sample No. 1.

10. SPIROLOCULINA ANTILLARUM, d'Orbigny.

Spiroloculina antillarum, Brady, 1884, Chall. Rep. vol. ix. p. 155, pl. x. fig. 21 *a*, *b*.

This species was found in Sample No. 1, rare.

11. SPIROLOCULINA LIMBATA, d'Orbigny.

Spiroloculina limbata, Brady, 1884, Chall. Rep. vol. ix. p. 150, pl. ix. figs. 15–17.

A specimen of the ordinary typical form was found in Sample No. 1.

12. SPIROLOCULINA GRATA, Terquem.

Spiroloculina grata, Brady, 1884, Chall. Rep. vol. ix. p. 155, pl. x. figs. 16, 17, 22, 23.

This species generally affects areas round coral-reefs, and is recorded from the shallow waters of the Red Sea, from shore-sand on the E. coast of Madagascar, and in various parts of the Pacific Ocean (Brady).

S. grata occurred in Sample No. 1, very rare; No. 2, frequent.

13. SPIROLOCULINA ARENARIA, Brady.

Spiroloculina arenaria, Brady, 1884, Chall. Rep. vol. ix. p. 153, pl. viii. fig. 12.

This moderately-shallow-water form has been noted from the Fiji Islands, Raine Island, and the Philippine Islands (Brady).

It occurred in Sample No. 4, rare.

14. SPIROLOCULINA ASPERULA, Karrer.

Spiroloculina asperula, Brady, 1884, Chall. Rep. vol. ix. p. 152, pl. viii. figs. 13, 14, and 11?

Found in Sample No. 4, rare.

MILIOLINA, Williamson.

15. MILIOLINA TRIGONULA (Lam.).

Miliolina trigonula, Brady, 1884, Chall. Rep. vol. ix. p. 164, pl. iii. figs. 14–16.

This form occurs in Sample No. 6, very rare.

16. MILIOLINA INSIGNIS, Brady.

Miliolina insignis, Brady, 1884, Chall. Rep. vol. ix. p. 165, pl. iv. figs. 8, 10.

Found in Sample No. 2, very rare.

17. MILIOLINA TRICARINATA (d'Orb.).

Miliolina tricarinata, Brady, 1884, Chall. Rep. vol. ix. p. 165, pl. iii. fig. 17 *a*, *b*.

Found in Sample No. 1, frequent; No. 2, very rare; No. 5, rare.

18. MILIOLINA CIRCULARIS (Bornemann).

Miliolina circularis, Brady, 1884, Chall. Rep. vol. ix. p. 169, pl. iv. fig. 3 *a–c*, pl. v. figs. 13, 14?

Found in Sample No. 1, very rare.

19. MILIOLINA AUBERIANA (d'Orb.).

Miliolina auberiana, Brady, 1884, Chall. Rep. vol. ix. p. 162, pl. v. figs. 8, 9.

Found in Sample No. 1, rare; No. 4, rare; No. 5, very rare.

20. MILIOLINA CUVIERIANA (d'Orb.).

Miliolina cuvieriana, Brady, 1884, Chall. Rep. vol. ix. p. 162, pl. v. fig. 12 *a–c*.

Found in Sample No. 5, very rare; No. 6, very rare.

21. MILIOLINA VENUSTA (Karrer).

Miliolina venusta, Brady, 1884, Chall. Rep. vol. ix. p. 162, pl. v. figs. 5, 7.

Found in Sample No. 1, rare.

22. MILIOLINA GRACILIS (d'Orb.).

Miliolina gracilis, Brady, 1884, Chall. Rep. vol. ix. p. 160, pl. v. fig. 3 *a–c*.

Found in Sample No. 1, very rare.

23. MILIOLINA AMYGDALOIDES, Brady.

Miliolina amygdaloides, Brady, 1884, Chall. Rep. vol. ix. p. 163, pl. vi. fig. 10 *a*, *b*.

Found in Sample No. 1, very rare.

24. MILIOLINA BICORNIS (W. & J.).

Miliolina bicornis, Brady, 1884, Chall. Rep. vol. ix. p. 171, pl. v. figs. 9, 11, 12.

Found in Sample No. 1, very rare.

25. MILIOLINA SCHREIBERSIANA (d'Orb.).

Triloculina schreibersiana, d'Orbigny, 1839, Foram. Cuba, p. 174, pl. ix. figs. 20–22.

This species was described by d'Orbigny from specimens obtained out of the shore-sand from the Island of Cuba. It was not met with in any of the soundings obtained by the 'Challenger.' As might be expected, this species occurs in the shallow-water deposits of Sample No. 2 from the Arabian Sea, and is very rare.

26. MILIOLINA UNDOSA (Karrer).

Miliolina undosa, Brady, 1884, Chall. Rep. vol. ix. p. 176, pl. vi. figs. 6–8.

Found in Sample No. 1, frequent.

27. MILIOLINA LINNÆANA (d'Orb.).

Miliolina linnæana, Brady, 1884, Chall. Rep. vol. ix. p. 174, pl. vi. figs. 15–20.

This shallow-water form has been before noted from the coral islands of the Pacific, &c. (Brady). In the gatherings from the Arabian Sea it occurs in Sample No. 1, and is very rare.

28. MILIOLINA RETICULATA (d'Orb.).

Miliolina reticulata, Brady, 1884, Chall. Rep. vol. ix. p. 177, pl. ix. figs. 2–4.

This species is essentially a shallow-water form, being found in shore-sands and in the neighbourhood of coral-reefs.

Found in Sample No. 1, frequent.

29. MILIOLINA PARKERI, Brady.

Miliolina parkeri, Brady, 1884, Chall. Rep. vol. ix. p. 177, pl. vii. fig. 14.

This form is also usually associated with coral-reefs.

Found in Sample No. 1, very rare.

30. MILIOLINA RUPERTIANA, Brady.

Miliolina rupertiana, Brady, 1884, Chall. Rep. vol. ix. p. 178, pl. vii. figs. 7–12.

Found in Sample No. 1, very rare.

OPHTHALMIDIUM, Kubler.

31. OPHTHALMIDIUM INCONSTANS, Brady.

Ophthalmidium inconstans, Brady, 1884, Chall. Rep. vol. ix. p. 189, pl. xii. figs. 5, 7, 8.

Found in Sample No. 1, very rare.

SIGMOÏLINA, Schlumberger.

32. SIGMOÏLINA SIGMOIDEA (Brady).

Planispirina sigmoidea, Brady, 1884, Chall. Rep. vol. ix. p. 197, pl. ii. figs. 1–3; woodcut fig. 5 *c*.

Sigmoïlina (*Planispirina*) *sigmoidea*, Schlumberger, 1887, Bull. Soc. Zool. France, vol. xii. p. 118, pl. vii. figs. 9–11; woodcuts, figs. 1–5.

Found in Sample No. 1, very rare.

33. SIGMOÏLINA CELATA (Costa).

Spiroloculina celata, Costa, 1855, Mem. Accad. Napoli, vol. ii. p. 126, pl. i. fig. 14; 1856, Atti dell' Accad. Pont. vol. vii. pl. xxvi. fig. 5.

Quinqueloculina asperula et *rugosa*, Schwager, 1866, Novara-Exped., geol. Theil, vol. ii. pp. 203, 266, pl. iv. fig. 16 *a–c*.

Planispirina celata, Brady, 1884, Chall. Rep. vol. ix. p. 197, pl. viii. figs. 1–4.

Sigmoïlina (*Planispirina*) *celata*, Schlumberger, 1887, Bull. Soc. Zool. France, vol. xii. p. 481, pl. vii. figs. 12–14; woodcuts, figs. 6, 7.

This is another of the forms found fossil in the Island of Kar Nicobar by Dr. Schwager.

Found in Sample No. 1, common; No. 3, rare; No. 4, rare; No. 5, rare; No. 6, rare.

CORNUSPIRA, Schultze.

34. CORNUSPIRA CARINATA (Costa).

Cornuspira carinata, Brady, 1884, Chall. Rep. vol. ix. p. 201 pl. xi. fig. 4 *a*, *b*.

Found in Sample No. 1, very rare.

ORBITOLITES, Lamarck.

35. ORBITOLITES COMPLANATA, Lamarck.

Orbitolites complanata, Brady, 1884, Chall. Rep. vol. ix. p. 218, pl. xvi. figs. 1–6.

Found in Sample No. 1, common.

36. ORBITOLITES MARGINALIS (Lam.).

Orbitolites marginalis, Brady, 1884, Chall. Rep. vol. ix. p. 214, pl. xv. figs. 1–5.

Found in Sample No. 1, rare.

ALVEOLINA, d'Orbigny.

37. ALVEOLINA MELO (F. & M.).

Alveolina melo, Brady, 1884, Chall. Rep. vol. ix. p. 223, pl. xvii. figs. 13–15.

This species is usually found in coral-sands down to a depth of 40 fathoms (Brady).

Found in Sample No. 1, very rare.

38. ALVEOLINA BOSCII (Defr.).

Alveolina boscii, Brady, 1884, Chall. Rep. vol. ix. p. 222, pl. xvii. figs. 7–12.

This species also is associated with coral-sands.

Found in Sample No. 1, common ; No. 2, rare.

TECHNITELLA, Norman.

39. TECHNITELLA MELO, Norman.

Technitella melo, Brady, 1884, Chall. Rep. vol. ix. p. 246, pl. xxv. fig. 7 *a*, *b*.

This species is rare, and has been recorded off Ascension Island at 420 fathoms (Brady); and from the N. Atlantic, S. of the Rockall Bank, at 1215 fathoms (Norman).

Found in Sample No. 4, very rare.

40. TECHNITELLA RAPHANUS, Brady.

Technitella raphanus, Brady, 1884, Chall. Rep. vol. ix. p. 247, pl. xxv. figs. 13, 14.

T. raphanus has been recorded from Kandavu, Fiji Ids., 210 fathoms (Brady).

In the soundings from the Arabian Sea it was found in Sample No. 4, frequent.

BATHYSIPHON, Sars.

41. BATHYSIPHON FILIFORMIS, Sars.

Bathysiphon filiformis, Brady, 1884, Chall. Rep. vol. ix. p. 248, pl. xxvi. figs. 15–20.

Found in Sample No. 4, very rare.

PSAMMOSPHÆRA, Schulze.

42. PSAMMOSPHÆRA FUSCA, F. E. Schulze.

Psammosphæra fusca, Brady, 1884, Chall. Rep. vol. ix. p. 249, pl. xviii. figs. 1–8.

Found in Sample No. 1, very rare.

SACCAMMINA, M. Sars.

43. SACCAMMINA SPHÆRICA, M. Sars.

Saccammina sphærica, Brady, 1884, Chall. Rep. vol. ix. p. 253, pl. xxiii. figs. 11–17.

Found in Sample No. 1, rare.

44. SACCAMMINA SOCIALIS, Brady.

Saccammina socialis, Brady, 1884, Chall. Rep. vol. ix. p. 255, pl. xviii. figs. 18, 19.

This species has been hitherto found in the North Atlantic and North Pacific Oceans (Brady).

It was found in Sample No. 5, very rare.

HYPERAMMINA, H. B. Brady.

45. HYPERAMMINA ELONGATA, Brady.

Hyperammina elongata, Brady, 1884, Chall. Rep. vol. ix. p. 257, pl. xxiii. figs. 4, 7–10.

Found in Sample No. 1, rare; No. 4, common; No. 5, very rare; No. 6, rare.

46. HYPERAMMINA RAMOSA, Brady.

Hyperammina ramosa, Brady, 1884, Chall. Rep. vol. ix. p. 261, pl. xxiii. figs. 15–19.

Found in Sample No. 1, frequent; No. 3, rare; No. 4, very common; No. 6, rare.

47. HYPERAMMINA ARBORESCENS (Norman).

Hyperammina arborescens, Brady, 1884, Chall. Rep. vol. ix. p. 262, pl. xxviii. figs. 12, 13.

Found in Sample No. 1, rare; No. 4, very rare.

MARSIPELLA, Norman.

48. MARSIPELLA ELONGATA, Norman.

Marsipella elongata, Brady, 1884, Chall. Rep. vol. ix. p. 264, pl. xxiv. figs. 10–19.

Found in Sample No. 4, rare.

RHABDAMMINA, M. Sars.

49. RHABDAMMINA DISCRETA, Brady.

Rhabdammina discreta, Brady, 1884, Chall. Rep. vol. ix. p. 268, pl. xxii. figs. 7–10.

Found in Sample No. 1, very rare; No. 4, frequent; No. 6, very rare.

RHIZAMMINA, H. B. Brady.

50. RHIZAMMINA INDIVISA, Brady.

Rhizammina indivisa, Brady, 1884, Chall. Rep. vol. ix. p. 277, pl. xxix. figs. 5–7.

Found in Sample No. 1, very rare; No. 4, common; No. 5, very rare.

REOPHAX, Montfort.

51. REOPHAX DIFFLUGIFORMIS, Brady.

Reophax difflugiformis, Brady, 1884, Chall. Rep. vol. ix. p. 289, pl. xxx. figs. 1–5.

The tests of these specimens from the Arabian Sea are composed of tiny embryonic globigerine shells in all cases excepting that from Sample No. 1, in which the specimen is composed of sandy and spicular material.

Found in Sample No. 1, very rare; No. 4, very rare; No. 5, very rare; No. 6, very rare.

52. REOPHAX SCORPIURUS (Montfort).

Reophax scorpiurus, Brady, 1884, Chall. Rep. vol. ix. p. 291, pl. xxx. figs. 12–17.

It is possible that one of the specimens referred to the above species, that from Sample No. 1, more properly belongs to *R. arctica*, Brady, since it has the usual tapering shell but strongly compressed. It differs, however, from the typical *R. arctica* in being quite as large as the well-known *R. scorpiurus*. The other specimens met with are of the ordinary type form.

Found in Sample No. 1, very rare; No. 4, frequent; No. 6, frequent.

53. REOPHAX SPICULIFERA, Brady.

Reophax spiculifera, Brady, 1884, Chall. Rep. vol. ix. p. 295, pl. xxxi. figs. 16, 17.

The usual form of this species has more or less cylindrical chambers; but some of the specimens from the Arabian Sea show a tendency to pass over into the form of *R. nodulosa*, Brady, whilst retaining the spicular test. It is therefore difficult to determine to which of the two above-mentioned species some of the specimens belong; the cylindrical form of the segments is here taken as the distinguishing character irrespective of the nature of the test.

R. spiculifera has hitherto been found off Kandavu, Fiji Islands, and Tahiti, Society Islands (Brady).

Found in Sample No. 1, rare; No. 4, very rare; No. 6, very rare.

54. REOPHAX DISTANS, Brady.

Reophax distans, Brady, 1884, Chall. Rep. vol. ix. p. 296, pl. xxxi. figs. 18–22.

Found in Sample No. 4, very rare.

55. REOPHAX NODULOSA, Brady.

Reophax nodulosa, Brady, 1884, Chall. Rep. vol. ix. p. 294, pl. xxxi. figs. 1–9.

As previously stated, I have included under this specific name some specimens which have the test formed mainly, if not entirely, of broken sponge-spicules but possessing oval or pyriform chambers. Associated with these are many specimens which have an arenaceous test, and which are therefore quite typical in character.

Found in Sample No. 1, frequent; No. 6, very rare.

56. REOPHAX DENTALINIFORMIS, Brady.

Reophax dentaliniformis, Brady, 1884, Chall. Rep. vol. ix. p. 293, pl. xxx. figs. 21, 22.

Found in Sample No. 1, rare; No. 3, very rare; No. 4, very rare; No. 5, very rare.

57. REOPHAX BACILLARIS, Brady.

Reophax bacillaris, Brady, 1884, Chall. Rep. vol. ix. p. 293, pl. xxx. figs. 23, 24.

Found in Sample No. 1, very rare.

58. REOPHAX PILULIFERA, Brady.

Reophax pilulifera, Brady, 1884, Chall. Rep. vol. ix. p. 292, pl. xxx. figs. 18–20.

Found in Sample No. 1, common.

HAPLOPHRAGMIUM, Reuss.

59. HAPLOPHRAGMIUM GLOMERATUM, Brady.

Haplophragmium glomeratum, Brady, 1884, Chall. Rep. vol. ix. p. 309, pl. xxxiv. figs. 15–18.

Found in Sample No. 6, rare.

60. HAPLOPHRAGMIUM LATIDORSATUM (Bornemann).

Haplophragmium latidorsatum, Brady, 1884, Chall. Rep. vol. ix. p. 307, pl. xxxiv. figs. 7–10, 14.

Found in Sample No. 1, rare; No. 4, common; No. 6, rare.

61. HAPLOPHRAGMIUM GLOBIGERINIFORME (P. & J.).

Haplophragmium globigeriniforme, Brady, 1884, Chall. Rep. vol. ix. p. 312, pl. xxxv. figs. 10, 11.

This species has been recorded by Parker and Jones from the Red Sea at 557 and 678 fathoms.

Found in Sample No. 1, rare; No. 6, rare.

62. HAPLOPHRAGMIUM CANARIENSE (d'Orb.).

Haplophragmium canariense, Brady, 1884, Chall. Rep. vol. ix. p. 310, pl. xxxv. figs. 1–5.

Found in Sample No. 1, very rare; No. 4, very rare; No. 6, very rare.

63. HAPLOPHRAGMIUM TURBINATUM, Brady.

Haplophragmium turbinatum, Brady, 1884, Chall. Rep. vol. ix. p. 312, pl. xxxv. fig. 9 *a–c*.

Found in Sample No. 1, very rare; No. 4, very rare; No. 6, very rare.

64. HAPLOPHRAGMIUM ROTULATUM, Brady.

Haplophragmium rotulatum, Brady, 1884, Chall. Rep. vol. ix. p. 306, pl. xxxiv. figs. 5, 6.

Found in Sample No. 1, very rare; No. 4, very rare; No. 6, very rare.

65. HAPLOPHRAGMIUM SCITULUM, Brady.

Haplophragmium scitulum, Brady, 1884, Chall. Rep. vol. ix. p. 308, pl. xxxiv. figs. 11–13.

Found in Sample No. 1, rare; No. 5, very rare; No. 6, rare.

66. HAPLOPHRAGMIUM EMACIATUM, Brady.

Haplophragmium emaciatum, Brady, 1884, Chall. Rep. vol. ix. p. 305, pl. xxxiii. figs. 26–28.

This species has been hitherto known only from the West Indies (Brady).

Found in Sample No. 5, very rare.

67. HAPLOPHRAGMIUM AGGLUTINANS (d'Orb.).

Haplophragmium agglutinans, Brady, 1884, Chall. Rep. vol. ix. p. 301, pl. xxxii. figs. 19–26.

Found in Sample No. 1, very rare.

68. HAPLOPHRAGMIUM TRUNCATULINIFORME, sp. nov. (Plate I. fig. 2 *a–c*.)

Test Rotaliform. Slightly concave on the superior, and strongly convex on the inferior face; the latter with a distinct umbilical depression. Only the last convolution, which consists of twelve chambers, can be seen on either face. Aperture strongly arched, and confined almost entirely to the inferior face. Walls arenaceous, of a yellow-brown colour, composed of fine material but with a few included coarser grains of a dark colour. Edge of test rounded. Diameter $\frac{1}{42}$ inch (·6 mm.).

This species supplies a link in the chain of isomorphs of the hyaline and arenaceous groups of Foraminifera, since it bears the same relation to a typical *Truncatulina* or a *Rotalia* as *Haplophragmium globigeriniforme* does to *Globigerina*.

H. truncatuliniforme is represented in the Arabian-Sea soundings by only one example, from Sample No. 6.

PLACOPSILINA, d'Orbigny.

69. PLACOPSILINA CENOMANA, d'Orbigny.

Placopsilina cenomana, Brady, 1884, Chall. Rep. vol. ix. p. 315, pl. xxxvi. figs. 1–3.

Found in Sample No. 6, very rare.

THURAMMINA, Brady.

70. THURAMMINA PAPILLATA, Brady.

Thurammina papillata, Brady, 1884, Chall. Rep. vol. ix. p. 321, pl. xxxvi. figs. 7–18.

Found in Sample No. 4, rare.

HORMOSINA, Brady.

71. HORMOSINA CARPENTERI, Brady.

Hormosina carpenteri, Brady, 1884, Chall. Rep. vol. ix. p. 327, pl. xxxix. figs. 14–18.

It is interesting to record this species from the Arabian Sea, since it has previously been almost entirely confined to soundings from the North Atlantic.

Found in Sample No. 1, very rare: No. 4, common; No. 6, frequent.

72. HORMOSINA OVICULA, Brady.

Hormosina ovicula, Brady, 1884, Chall. Rep. vol. ix. p. 327, pl. xxxix. figs. 7–9.

Found in Sample No. 1, very rare.

73. HORMOSINA GLOBULIFFRA, Brady.

Hormosina globulifera, Brady, 1884, Chall. Rep. vol. ix. p. 326, pl. xxxix. figs. 1–6.

Found in Sample No. 6, very rare.

AMMODISCUS, Reuss.

74. AMMODISCUS INCERTUS (d'Orb.).

Ammodiscus incertus, Brady, 1884, Chall. Rep. vol. ix. p. 330, pl. xxxviii. figs. 1–3.

Found in Sample No. 1, rare; No. 4, rare; No. 6, very rare.

75. AMMODISCUS TENUIS, Brady.

Ammodiscus tenuis, Brady, 1884, Chall. Rep. vol. ix. p. 332, pl. xxxviii. figs. 4–6.

Found in Sample No. 6, very rare.

76. AMMODISCUS CHAROIDES (J. & P.).

Ammodiscus charoides, Brady, 1884, Chall. Rep. vol. ix. p. 334, pl. xxxviii. figs. 10–16.

This species is recorded by Parker and Jones from the Red Sea amongst other localities.

Found in Sample No. 1, very rare.

TROCHAMMINA, Parker & Jones.

77. TROCHAMMINA TRULISSATA, Brady.

Trochammina trulissata, Brady, 1884, Chall. Rep. vol. ix. p. 342, pl. xl. figs. 13–16.

Found in Sample No. 1, frequent; No. 4, frequent; No. 6, rare.

WEBBINA, d'Orbigny.

78. WEBBINA CLAVATA, J. & P.

Webbina clavata, Brady, 1884, Chall. Rep. vol. ix. p. 349, pl. xli. figs. 12–16.

Found in Sample No. 4, frequent; No. 6, very rare.

CYCLAMMINA, Brady.

79. CYCLAMMINA PUSILLA, Brady.

Cyclammina pusilla, Brady, 1884, Chall. Rep. vol. ix. p. 353, pl. xxxvii. figs. 20–23.

Found in Sample No. 1, rare; No. 3, very rare; No. 4, frequent; No. 6, rare.

80. CYCLAMMINA CANCELLATA, Brady.

Cyclammina cancellata, Brady, 1884, Chall. Rep. vol. ix. p. 351, pl, xxxvii. figs. 8–16.

Found in Sample No. 6, rare.

TEXTULARIA, Defrance.

81, TEXTULARIA SAGITTULA, Defrance.

Textularia sagittula, Brady, 1884, Chall. Rep. vol. ix. p. 361, pl. xlii. figs. 17, 18.

Found in Sample No. 4, rare; No. 5, very rare; No. 6, very rare.

82. TEXTULARIA SAGITTULA, var. FISTULOSA, Brady.

Textularia sagittula, Brady, 1884, Chall. Rep. vol. ix. p. 362, pl. xlii. figs. 19–22.

Found in Sample No. 1, rare.

83. TEXTULARIA GRAMEN, d'Orb.

Textularia gramen, Brady, 1884, Chall. Rep. vol. ix. p. 365, pl. xliii. figs. 9, 10.

Found in Sample No. 1, frequent.

84. TEXTULARIA LYTHOSTROTUM (Schwager).

Textularia lythostrotum, Schwager, 1866, Novara-Exped., geol. Theil, vol. ii. p. 194, pl. iv. fig. 4 *a–c*.

This species is one of those which have not been recorded from the 'Challenger' gatherings. *T. lythostrotum* was first described from the Pliocene deposits of Kar Nicobar; it is a very striking form, and is somewhat like *T. gramen* in contour, though with more parallel sides, and the test altogether is very much flattened, the margins being thin and sharp. The surface of the test is usually very rough.

Found in Sample No. 1, frequent; No. 2, very rare; No. 4, rare; No. 6, common.

85. TEXTULARIA CONICA, d'Orb.

Textularia conica, Brady, 1884, Chall. Rep. vol. ix. p. 365, pl. xliii. figs. 13, 14, pl. cxiii. fig. 1 *a*, *b*.

Found in Sample No. 6, very rare.

86. TEXTULARIA AGGLUTINANS, d'Orb.

Textularia agglutinans, Brady, 1884, Chall. Rep. vol. ix. p. 363, pl. xliii. figs. 1–3.

Found in Sample No. 1, rare; No. 6, common.

VERNEUILINA, d'Orbigny.

87. VERNEUILINA PYGMÆA (Egger).

Verneuilina pygmæa, Brady, 1884, Chall. Rep. vol. ix. p. 385, pl. xlvii. figs. 4–7.

Found in Sample No. 1, frequent; No. 4, rare.

88. VERNEUILINA PROPINQUA, Brady.

Verneuilina propinqua, Brady, 1884, Chall. Rep. vol. ix. p. 387, pl. xlvii. figs. 8–14.

Found in Sample No. 1, very rare; No. 4, rare.

CHRYSALIDINA, d'Orbigny.

89. CHRYSALIDINA DIMORPHA, Brady.

Chrysalidina dimorpha, Brady, 1884, Chall. Rep. vol. ix. p. 388, pl. xlvi. figs. 20, 21.

This species is usually met with in shallow-water deposits, near coral-islands, and also in shore-sands (Brady).

Found in Sample No. 2, rare; No. 5, very rare.

GAUDRYINA, d'Orbigny.

90. GAUDRYINA PUPOIDES, d'Orb.

Gaudryina pupoides, Brady, 1884, Chall. Rep. vol. ix. p. 378, pl. xlvi. figs. 1–4.

Found in Sample No. 1, rare; No. 4, very rare; No. 6, very rare.

91. GAUDRYINA RUGOSA, d'Orb.

Gaudryina rugosa, Brady, 1884, Chall. Rep. vol. ix. p. 381, pl. xlvi. figs. 14–16.

The specimens from the Arabian Sea gatherings are extremely large (about $\frac{1}{8}$ inch in length) and well developed.

Found in Sample No. 1, frequent; No. 3, rare; No. 4, common; No. 6, frequent.

92. GAUDRYINA SUBROTUNDATA, Schwager.

Gaudryina subrotundata, Schwager, 1866, Novara-Exped., geol. Theil, vol. ii. p. 198, pl. iv. fig. 9 *a–c*; Brady, 1884, Chall. Rep. vol. ix. p. 380, pl. xlvi. fig. 13 *a–c*.

This form was first described by Schwager from the fossil specimens of the Pliocene beds of Kar Nicobar. It has also been found fossil in Miocene beds of Baden (*G. prælonga*, Karrer). As a recent form it has been recorded from soundings off Culebra Island at 390 fathoms, and off Raine Island at 155 fathoms (Brady).

Found in Sample No. 1, common; No. 4, frequent; No. 6, common.

93. GAUDRYINA BACCATA, Schwager.

Gaudryina baccata, Schwager, 1866, Novara-Exped., geol. Theil, vol. ii. p. 200, pl. iv. fig. 12 *a, b*; Brady, 1884, Chall. Rep. vol. ix. p. 379, pl. xlvi. figs. 8–11.

This species is one of those originally described by Dr. Schwager from the Pliocene of Kar Nicobar. It has also been recorded by Dr. Brady from various stations in the Atlantic and Pacific Oceans.

Found in Sample No. 2, very rare.

94. GAUDRYINA SIPHONELLA, Reuss.

Gaudryina siphonella, Brady, 1884, Chall. Rep. vol. ix. p. 382, pl. xlvi. figs. 17–19.

Found in Sample No. 5, very rare; No. 6, very rare.

VALVULINA, d'Orbigny.

95. VALVULINA CONICA, Parker & Jones.

Valvulina conica, Brady, 1884, Chall. Rep. vol. ix. p. 392, pl. xlix. figs. 15, 16.

Found in Sample No. 1, rare; No. 6, very rare.

CLAVULINA, d'Orbigny.

96. CLAVULINA COMMUNIS, d'Orbigny.

Clavulina communis, Brady, 1884, Chall. Rep. vol. ix. p. 394, pl. xlviii. figs. 1–13.

Many of the specimens of *C. communis* from the Arabian Sea are greatly elongated, and frequently attain a length of $\frac{1}{6}$ inch.

Found in Sample No. 1, frequent; No. 3, frequent; No. 4, common; No. 5, rare; No. 6, rare.

97. CLAVULINA PARISIENSIS, d'Orbigny.

Clavulina parisiensis, Brady, 1884, Chall. Rep. vol. ix. p. 395, pl. xlviii. figs. 14–18.

Found in Sample No. 1, very rare.

98. CLAVULINA ANGULARIS, d'Orbigny.

Clavulina angularis, Brady, 1884, Chall. Rep. vol. ix. p. 396 pl. xlviii. figs. 22–24.

Found in Sample No. 1, rare.

BULIMINA, d'Orbigny.

99. BULIMINA OVATA, d'Orbigny.

Bulimina ovata, Brady, 1884, Chall. Rep. vol. ix. p. 400, pl. l. fig. 13 *a*, *b*.

Found in Sample No. 1, frequent; No. 4, rare; No. 5, very rare.

100. BULIMINA PYRULA, d'Orbigny.

Bulimina pyrula, Brady, 1884, Chall. Rep. vol. ix. p. 399, pl. l. figs. 7–10.

Found in Sample No. 1, frequent; No. 3, rare; No. 5, very rare.

101. BULIMINA ELONGATA, d'Orbigny.

Bulimina elongata, Brady, 1884, Chall. Rep. vol. ix. p. 401, pl. li. figs. 1, 2?

Found in Sample No. 1, very rare.

102. Bulimina pupoides, d'Orbigny.

Bulimina pupoides, Brady, 1884, Chall. Rep. vol. ix. p. 400, pl. l. fig. 15 *a*, *b*.

Found in Sample No. 1, very rare; No. 3, very rare.

103. Bulimina affinis, d'Orbigny.

Bulimina affinis, Brady, 1884, Chall. Rep. vol. ix. p. 400, pl. l. fig. 14 *a*, *b*.

Found in Sample No. 1, rare.

104. Bulimina elegans, d'Orbigny.

Bulimina elegans, Brady, 1884, Chall. Rep. vol. ix. p. 398, pl. l. figs. 1–4.

Found in Sample No. 1, very rare.

105. Bulimina subcylindrica, Brady.

Bulimina subcylindrica, Brady, 1884, Chall. Rep. vol. ix. p. 404, pl. l. fig. 16 *a*, *b*.

Found in Sample No. 1, rare.

106. Bulimina declivis, Reuss.

Bulimina declivis, Brady, 1884, Chall. Rep. vol. ix. p. 404, pl. l. fig. 19 *a*, *b*.

Found in Sample No. 1, very rare.

107. Bulimina contraria (Reuss).

Bulimina contraria, Brady, 1884, Chall. Rep. vol. ix. p. 409, pl. liv. fig. 18 *a–c*.

Found in Sample No. 1, frequent; No. 4, rare; No. 5, very rare; No. 6, frequent.

108. Bulimina aculeata, d'Orbigny.

Bulimina aculeata, Brady, 1884, Chall. Rep. vol. ix. p. 406, pl. li. figs. 7–9.

Found in Sample No. 1, very common; No. 3, rare; No. 5, frequent; No. 6, very rare.

109. Bulimina buchiana, d'Orbigny.

Bulimina buchiana, Brady, 1884, Chall. Rep. vol. ix. p. 407, pl. li. figs. 18, 19.

Found in Sample No. 1, very rare; No. 4, very rare; No. 5, very rare.

110. Bulimina inflata, Seguenza.

Bulimina inflata, Brady, 1884, Chall. Rep. vol. ix. p. 406, pl. li. figs. 10–13.

Besides occurring in other Tertiary deposits, Schwager records this species from the Pliocene beds of Kar Nicobar.

Found in Sample No. 1, very rare; No. 6, very rare.

111. **BULIMINA SUBORNATA**, Brady.

Bulimina subornata, Brady, 1884, Chall. Rep. vol. ix. p. 402, pl. li. fig. 6 *a*, *b*.

This rare species was found by Dr. Brady on the *Hyalonema*-ground S. of Japan, at 345 fathoms, and off Aru Island, 800 fathoms.

Found in Sample No. 2, very rare; No. 5, very rare.

112. **BULIMINA ROSTRATA**, Brady.

Bulimina rostrata, Brady, 1884, Chall. Rep. vol. ix. p. 408, pl. li. figs. 14, 15.

Found in Sample No. 5, rare.

VIRGULINA, d'Orbigny.

113. **VIRGULINA SCHREIBERSIANA**, Czjzek.

Virgulina schreibersiana, Brady, 1884, Chall. Rep. vol. ix. p. 414, pl. lii. figs. 1–3.

Found in Sample No. 1, very rare; No. 5, very rare.

114. **VIRGULINA SUBSQUAMOSA**, Egger.

Virgulina subsquamosa, Brady, 1884, Chall. Rep. vol. ix. p. 415, pl. lii. figs. 7–11.

Found in Sample No. 1, rare.

115. **VIRGULINA SUBDEPRESSA**, Brady.

Virgulina subdepressa, Brady, 1884, Chall. Rep. vol. ix. p. 416, pl. lii. figs. 14–17.

Found in Sample No. 5, very rare.

BOLIVINA, d'Orbigny.

116. **BOLIVINA PUNCTATA**, d'Orb.

Bolivina punctata, Brady, 1884, Chall. Rep. vol. ix. p. 417, pl. lii. figs. 18, 19.

Found in Sample No. 1, very rare.

117. **BOLIVINA TEXTILARIOIDES**, Reuss.

Bolivina textilarioides, Brady, 1884, Chall. Rep. vol. ix. p. 419, pl. lii. figs. 23–25.

Found in Sample No. 5, very rare.

118. **BOLIVINA LIMBATA**, Brady.

Bolivina limbata, Brady, 1884, Chall. Rep. vol. ix. p. 419, pl. lii. figs. 26–28.

Found in Sample No. 1, very rare; No. 5, very rare.

119. BOLIVINA NOBILIS, Hantken.

Bolivina nobilis, Brady, 1884, Chall. Rep. vol. ix. p. 424, pl. liii. figs. 14, 15.

Found in Sample No. 1, very rare; No. 5, rare.

120. BOLIVINA BEYRICHI, Reuss.

Bolivina beyrichi, Brady, Chall. Rep. vol. ix. p. 422, pl. liii. fig. 1.

121. BOLIVINA OBSOLETA, Eley.

Bolivina obsoleta, Eley, 1859, Geol. in the Garden, p. 195, pl. ii. fig. 11, p. 202, pl. viii. fig. 11 *c*.

Textilaria quadrilatera, Schwager, 1866, Novara-Exped., geol. Theil, vol. ii. p. 253, pl. vii. fig. 103.

Textularia quadrilatera, Brady, 1884, Chall. Rep. vol. ix. p. 358, pl. xlii. figs. 8–12.

Dr. Brady records this form (*T. quadrilatera*) from various stations in the Atlantic and Pacific Oceans, at depths between 350 and 1350 fathoms. That author also suggests that the form belongs rather to the genus *Bolivina* than to *Textularia*, on account of the compression of the test, together with the shape of the aperture. The species *T. quadrilatera* was originally described as a fossil from the Pliocene of Kar Nicobar; but was previously known from the Upper Chalk under the name of *Bolivina obsoleta*. The characters of both the recent and fossil forms are so nearly parallel as to satisfy the most critical student.

Found in Sample No. 1, rare; No. 5, very rare.

122. BOLIVINA ROBUSTA, Brady.

Bolivina robusta, Brady, 1884, Chall. Rep. vol. ix. p. 421, pl. liii. figs. 7–9.

Found in Sample No. 5, very rare.

123. BOLIVINA ARENOSA, sp. nov. (Plate I. fig. 3 *a*, *b*.)

Test rhomboidal, compressed; consisting of about 13 chambers. Aboral end of test sharply angular. The earlier chambers are linear, but rapidly increase in breadth. Peripheral edge of the test somewhat sharp; and the outline on the lateral aspect sinuous. Aperture an elongate slit. Test of a pale ochreous brown colour, finely arenaceous, but with a few coarser particles interspersed. Length $\frac{1}{23}$ inch (1·08 mm.); breadth $\frac{1}{27}$ inch (·926 mm.).

The above species is an exceptional one in the genus *Bolivina*, species of that group usually possessing hyaline tests. The vertical position and slit-like form of the aperture, however, separate it from the genus *Textularia*.

Found in Sample No. 1, very rare.

PLEUROSTOMELLA, Reuss.

124. PLEUROSTOMELLA SUBNODOSA, Reuss.

Pleurostomella subnodosa, Brady, 1884, Chall. Rep. vol. ix. p. 412, pl. lii. figs. 12, 13.

Found in Sample No. 1, rare.

125. PLEUROSTOMELLA ALTERNANS, Schwager.

Pleurostomella alternans, Schwager, 1866, Novara-Exped., geol. Theil, vol. ii. p. 238, pl. vi. figs. 79, 80; Brady, 1884, Chall. Rep. vol. ix. p. 412, pl. li. figs. 22, 23.

This species was originally described by Dr. Schwager from the Pliocene beds of Kar Nicobar. It has been recorded by Dr. Brady from the Ki Islands, S.W. of Papua, 129 fathoms; and S.W. of the Low Archipelago, 2075 fathoms.

Found in Sample No. 6, rare.

Subfamily CASSIDULININÆ.

CASSIDULINA, d'Orbigny.

126. CASSIDULINA MURRHYNA (Schwager).

Sphæroidina murrhyna, Schwager, 1866, Novara-Exped., geol. Theil, vol. ii. p. 250, pl. vii. fig. 97.

This species has not been hitherto recorded from deep-sea soundings. It was described by Schwager from the Pliocene beds of Kar Nicobar.

Found in Sample No. 3, very rare; No. 4, frequent; No. 5, very rare; No. 6, frequent.

127. CASSIDULINA CALABRA (Seguenza).

Cassidulina calabra, Brady, 1884, Chall. Rep. vol. ix. p. 431, pl. cxiii. fig. 8 *a–c*.

Recorded from Raine Island, 155 fathoms; Kandavu, Fiji Ids., 610 fathoms (Brady).

Found in Sample No. 5, rare; No. 6, common.

128. CASSIDULINA SUBGLOBOSA, Brady.

Cassidulina subglobosa, Brady, 1884, Chall. Rep. vol. ix. p. 430, pl. liv. fig. 17 *a–c*.

Found in Sample No. 1, very rare.

129. CASSIDULINA BRADYI, Norman.

Cassidulina bradyi, Brady, 1884, Chall. Rep. vol. ix. p. 431, pl. liv. figs. 6–10.

Found in Sample No. 1, rare.

130. CASSIDULINA PARKERIANA, Brady.

Cassidulina parkeriana, Brady, 1884, Chall. Rep. vol. ix. p. 432, pl. liv. figs. 11–16.

Hitherto this species has been recorded solely from soundings taken around the islands off the west coast of Patagonia, at depths of 145–175 fathoms (Brady).

Found in Sample No. 6, very rare.

131. CASSIDULINA LÆVIGATA, d'Orbigny.

Cassidulina lævigata, Brady, 1884, Chall. Rep. vol. ix. p. 428, pl. liv. figs. 1–3.

Found in Sample No. 1, rare; No. 5, very rare.

EHRENBERGINA, Reuss.

132. EHRENBERGINA SERRATA, Reuss.

Ehrenbergina serrata, Brady, 1884, Chall. Rep. vol. ix. p. 434, pl. lv. figs. 2–7.

This species was pointed out by Dr. Brady to be not uncommon in recent soundings; he records it off the Azores, 450 fathoms; off the Canaries, 620 fathoms; from the S. Atlantic, 1025 to 2350 fathoms; from the N. Pacific, at 2340 fathoms; and from the S. Pacific, from 150 to 2075 fathoms.

Reuss and Karrer record it from the Miocene beds in the neighbourhood of Vienna.

Found in Sample No. 1, rare; No. 2, frequent; No. 5, frequent.

CHILOSTOMELLA, Reuss.

133. CHILOSTOMELLA OVOIDEA, Reuss.

Chilostomella ovoidea, Brady, 1884, Chall. Rep. vol. ix. p. 436, pl. lv. figs. 12–23.

Found in Sample No. 1, rare; No. 3, very rare.

ALLOMORPHINA, Reuss.

134. ALLOMORPHINA TRIGONA, Reuss.

Allomorphina trigona, Brady, 1884, Chall. Rep. vol. ix. p. 438, pl. lv. figs. 24–26.

This rare foraminifer has previously been recorded from the *Hyalonema*-ground, south of Japan, at 345 fathoms; and off Tahiti, Society Islands, at 620 fathoms (Brady).

Found in Sample No. 6, very rare.

LAGENA, Walker and Boys.

135. LAGENA LÆVIS (Montagu).

Lagena lævis, Brady, 1884, Chall. Rep. vol. ix. p. 455, pl. lvi. figs. 7–14, 30.

Found in Sample No. 1, rare.

136. LAGENA GLOBOSA (Montagu).

Lagena globosa, Brady, 1884, Chall. Rep. vol. ix. p. 452, pl. lvi. figs. 1–3.

Found in Sample No. 6, very rare.

137. LAGENA APICULATA, Reuss.

Lagena apiculata, Brady, 1884, Chall. Rep. vol. ix. p. 453, pl. lvi. figs. 4, 15–18.

Found in Sample No. 1, rare.

138. LAGENA DISTOMA, Parker & Jones.

Lagena distoma, Brady, 1884, Chall. Rep. vol. ix. p. 461, pl. lviii. figs. 11–15.

Found in Sample No. 1, very rare.

139. LAGENA HISPIDA, Reuss.

Lagena hispida, Brady, 1884, Chall. Rep. vol. ix. p. 459, pl. lvii. figs. 1–4, pl. lix. figs. 2, 5.

Found in Sample No. 1, very rare.

140. LAGENA ASPERA, Reuss, var. SPINIFERA, nov. (Plate I. fig. 4.)

This variety of Reuss's species has the aboral end beset with moderately long spines. Length of the body of the test $\frac{1}{22}$ inch (1·136 mm.).

Found in Sample No. 4, very rare.

141. LAGENA SULCATA (Walker & Jacob).

Lagena sulcata, Brady, 1884, Chall. Rep. vol. ix. p. 462, pl. lvii. figs. 23, 26, 33, 34.

Found in Sample No. 6, very rare.

142. LAGENA GRACILIS, Williamson.

Lagena gracilis, Schwager, 1866, Novara-Exped., geol. Theil, vol. ii. p. 206, pl. iv. fig. 21 *a*, *b*; Brady, 1884, Chall. Rep. vol. ix. p. 464, pl. lviii. figs. 2, 3, 7–10, 19, 22–24.

This species was also recorded as a fossil from Kar Nicobar.

Found in Sample No. 1, very rare; No. 5, very rare.

143. LAGENA FEILDENIANA, Brady.

Lagena feildeniana, Brady, 1884, Chall. Rep. vol. ix. p. 469, pl. lviii. figs. 38, 39.

Found in Sample No. 3, very rare.

144. LAGENA DESMOPHORA, O. Rymer Jones.

Lagena desmophora, Brady, 1884, Chall. Rep. vol. ix. p. 468, pl. lviii. figs. 42, 43.

Found in Sample No. 1, rare; No. 3, very rare; No. 5, very rare.

145. Lagena hexagona, Williamson.

Lagena hexagona, Brady, 1884, Chall. Rep. vol. ix. p. 472, pl. lviii. figs. 32, 33.

Found in Sample No. 1, rare.

146. Lagena marginata (Walker & Jacob).

Lagena marginata, Brady, 1884, Chall. Rep. vol. ix. p. 476, pl. lix. figs. 21–23.

Found in Sample No. 4, very rare; No. 5, rare; No. 6, very rare.

147. Lagena marginata (Walker & Jacob), var. catenulosa, nov. (Plate I. fig. 5 *a*, *b*.)

This beautiful variety belongs to the wide-flanged type of *L. marginata*. On the lateral aspect the test is decorated with two or more chain-like borders encircling the bulbous portion. A remarkable feature about this variety is its apiculate base, encompassed, however, within the thin outer flange. The oral extremity of the test is distinctly phialine or lipped, partially closed over with redundant shell-growth, and showing a secondary tubular (true) orifice within. The outer flange is mined by a microscopic boring plant. Length of test $\frac{1}{17}$ inch (1·47 mm.).

One example found in Sample No. 6, very rare.

148. Lagena seminiformis, Schwager.

Lagena seminiformis, Schwager, 1866, Novara-Exped., geol. Theil, vol. ii. p. 208, pl. v. fig. 21; Brady, 1884, Chall. Rep. vol. ix. p. 478, pl. lix. figs. 28–30.

This species was recorded as a Pliocene fossil from Kar Nicobar (*Schwager*).

Found in Sample No. 5, very rare.

149. Lagena lagenoides (Williamson).

Lagena lagenoides, Brady, 1884, Chall. Rep. vol. ix. p. 479, pl. lx. figs. 6, 7, 9, 12, 14.

Found in Sample No. 5, very rare.

150. Lagena capillosa (Schwager).

Fissurina capillosa, Schwager, 1866, Novara-Exped., geol. Theil, vol. ii. p. 210, pl. v. fig. 25.

This species is one of those which have not been met with before in deep-sea soundings, and was described from the Pliocene deposits of Kar Nicobar.

Found in Sample No. 6, very rare.

151. Lagena fimbriata, Brady.

Lagena fimbriata, Brady, 1884, Chall. Rep. vol. ix. p. 486, pl. lx. figs. 26–28.

Found in Sample No. 1, very rare.

152. Lagena castrensis, Schwager.

Lagena castrensis, Schwager, 1866, Novara-Exped., geol. Theil, vol. ii. p. 208, pl. v. fig. 22; Brady, 1884, Chall. Rep. vol. ix. p. 485, pl. lx. figs. 1, 2, 3?

This species occurred in the Pliocene deposits of Kar Nicobar.

Found in Sample No. 1, very rare; No. 5, rare.

153. Lagena staphyllearia (Schwager).

Fissurina staphyllearia, Schwager, 1866, Novara-Exped., geol. Theil, vol. ii. p. 209, pl. v. fig. 24.

Lagena staphyllearia, Brady, 1884, Chall. Rep. vol. ix. p. 474, pl. lix. figs. 8–11.

This species occurred in the Pliocene beds of Kar Nicobar.

Found in Sample No. 1, very rare.

154. Lagena alveolata, var. substriata, Brady.

Lagena alveolata, var. *substriata*, Brady, 1884, Chall. Rep. vol. ix. p. 488, pl. lx. fig. 34.

This variety was recorded from the Southern Ocean, from 1375 fathoms (Brady).

Found in Sample No. 1, very rare; No. 6, very rare.

155. Lagena quadricostulata, Reuss.

Lagena quadricostulata, Brady, 1884, Chall. Rep. vol. ix. p. 486, pl. lix. figs. 15 and 7?

Found in Sample No. 1, very rare; No. 6, very rare.

156. Lagena lævigata (Reuss).

Lagena lævigata, Brady, 1884, Chall. Rep. vol. ix. p. 473, pl. cxiv. fig. 8 *a*, *b*.

Found in Sample No. 1, very rare.

157. Lagena orbignyana (Seguenza).

Lagena orbignyana, Brady, 1884, Chall. Rep. vol. ix. p. 484, pl. lix. figs. 1, 18, 20, 24–26.

Found in Sample No. 1, rare; No. 5, rare; No. 6, frequent.

158. Lagena formosa, Schwager.

Lagena formosa, Schwager, 1866, Novara-Exped., geol. Theil, vol. ii. p. 206, pl. iv. fig. 19 *a–d*; Brady, 1884, Chall. Rep. vol. ix. p. 480, pl. lx. figs. 10, 18–20, 8?, 17?

This species was originally described from the Pliocene of Kar Nicobar.

Found in Sample No. 1, rare; No. 6, very rare.

159. Lagena trigono-ornata, Brady.

Lagena trigono-ornata, Brady, 1884, Chall. Rep. vol. ix. p. 483, pl. lxi. fig. 14.

Found in Sample No. 1, rare.

160. LAGENA QUADRALATA, Brady.

Lagena quadralata, Brady, 1884, Chall. Rep. vol. ix. p. 464, pl. lxi. fig. 3 *a*, *b*.

This species has before been recorded from two localities south of Australia at 2600 fathoms, and in the South Atlantic, mid-ocean, 2200 fathoms.

Found in Sample No. 1, very rare.

NODOSARIA, Lamarck.

161. NODOSARIA (DENTALINA) CALOMORPHA, Reuss.

Nodosaria (*Dentalina*) *calomorpha*, Brady, 1884, Chall. Rep. vol. ix. p. 497, pl. lxi. figs. 23–27.

Found in Sample No. 5, rare.

162. NODOSARIA RADICULA (Linn.).

Nodosaria radicula, Brady, 1884, Chall. Rep. vol. ix. p. 495, pl. lxi. figs. 28–31.

Found in Sample No. 1, rare; No. 6, rare.

163. NODOSARIA PYRULA, d'Orbigny.

Nodosaria pyrula, Schwager, 1866, Novara-Exped., geol. Theil, vol. ii. p. 217, pl. v. fig. 38; Brady, 1884, Chall. Rep. vol. ix. p. 497, pl. lxii. figs. 10–12.

This species was also found fossil in the Pliocene deposit of Kar Nicobar.

Found in Sample No. 1, very rare; No. 5, very rare.

164. NODOSARIA (DENTALINA) FARCIMEN, Reuss (after Soldani).

Nodosaria (*Dentalina*) *farcimen*, Brady, 1884, Chall. Rep. vol. ix. p. 498, pl. lxii. figs. 17, 18, woodcut fig. 13 *a–c*.

Found in Sample No. 1, very rare.

165. NODOSARIA (DENTALINA) FILIFORMIS, d'Orbigny.

Nodosaria (*Dentalina*) *filiformis*, Brady, 1884, Chall. Rep. vol. ix. p. 500, pl. lxii. figs. 3–5.

Found in Sample No. 1, very rare.

166. NODOSARIA (DENTALINA) ROEMERI (Neugeboren).

Nodosaria (*Dentalina*) *roemeri*, Brady, 1884, Chall. Rep. vol. ix. p. 505, pl. lxiii. fig. 1.

Found in Sample No. 1, rare; No. 4, very rare.

167. NODOSARIA (DENTALINA) COMMUNIS, d'Orbigny.

Nodosaria (*Dentalina*) *communis*, Brady, 1884, Chall. Rep. vol. ix. p. 504, pl. lxii. figs. 19–22.

Found in Sample No. 1, common; No. 3, very rare; No. 5, rare; No. 6, rare.

168. NODOSARIA (DENTALINA) CONSOBRINA (d'Orbigny).

Nodosaria (Dentalina) consobrina, Brady, 1884, Chall. Rep. vol. ix. p. 501, pl. lxii. figs. 23, 24.

Found in Sample No. 1, rare; No. 2, very rare.

169. NODOSARIA (DENTALINA) INFLEXA, Reuss.

Nodosaria (Dentalina) inflexa, Brady, 1884, Chall. Rep. vol. ix. p. 498, pl. lxii. fig. 9.

Found in Sample No. 5, rare.

170. NODOSARIA OVULATA, Sherborn & Chapman.

Nodosaria ovulata, Sherborn and Chapman, 1886, Journ. Roy. Micr. Soc. ser. 2, vol. vi. p. 747, pl. xiv. fig. 27.

This species was described for the first time from the London Clay of Piccadilly. The specimens from the Arabian Sea agree very closely with the fossil ones.

Found in Sample No. 5, rare.

171. NODOSARIA (DENTALINA) SOLUTA, Reuss.

Nodosaria (Dentalina) soluta, Brady, 1884, Chall. Rep. vol. ix. p. 503, pl. lxii. figs. 13–16.

Found in Sample No. 4, very rare; No. 6, rare.

172. NODOSARIA (DENTALINA) SOLUTA, var. SUBACULEATA, nov. (Plate I. fig. 6.)

"Faintly striate specimen."—*See* Brady, 1884, Chall. Rep. vol. ix. p. 503, pl. lxiv. fig. 28.

This variety differs from the type form in having the basal half of each chamber ornamented with numerous fine prickles, which fade off into faint striæ towards the middle of the bulb. The general contour of the test of this variety agrees with that of the type; and the examples found are well-developed in point of size. Length about $\frac{1}{5}$ inch (5 mm.).

Dr. Brady has figured a specimen which is undoubtedly referable to the above variety, though it is not so strongly ornamented as are the specimens from the Arabian Sea. For this reason I venture to separate them from the smooth typical forms by a varietal name.

Found in Sample No. 1, rare; No. 3, very rare; No. 4, rare; No. 5, very rare.

173. NODOSARIA (DENTALINA) ACICULA (Lamarck).

Orthocera acicula, Lamarck, 1822, Hist. Anim. sans Vert. vol. vii. p. 594, no. 5.

Dentalina acicula, Sherborn and Chapman, 1886, Journ. Roy. Micr. Soc. ser. 2, vol. vi. p. 751, woodcut fig. 154.

This species is well known as a Tertiary fossil, Lamarck having found it in the Middle Eocene of the Paris Basin; and it is also characteristic of the London Clay. It does not appear to have been noticed before as a recent form.

Found in Sample No. 6, very rare.

174. NODOSARIA SCALARIS (Batsch).

Nodosaria scalaris, Brady, 1884, Chall. Rep. vol. ix. p. 510, pl. lxiii. figs. 28–31.

Found in Sample No. 1, very rare.

175. NODOSARIA SCALARIS (Batsch), var. SEPARANS, Brady.

Nodosaria scalaris, var. *separans*, Brady, 1884, Chall. Rep. vol. ix. p. 510, pl. lxiv. figs. 16–19.

Found in Sample No. 1, very rare.

176. NODOSARIA (DENTALINA) OBLIQUA (Linn.).

Nodosaria (Dentalina) obliqua, Brady, 1884, Chall. Rep. vol. ix. p. 513, pl. lxiv. figs. 20–22.

Found in Sample No. 1, very rare.

177. NODOSARIA RAPHANUS (Linn.).

Nodosaria raphanus, Brady, 1884, Chall. Rep. vol. ix. p. 512, pl. lxiv. figs. 6–10.

Found in Sample No. 1, very rare; No. 5, rare.

178. NODOSARIA (DENTALINA) ADOLPHINA (d'Orb.).

Dentalina adolphina, d'Orbigny, 1846, Foram. Foss. Vien. p. 51, pl. ii. figs. 18–20.

Nodosaria adolphina, Schwager, 1866, Novara-Exped., geol. Theil, vol. ii. p. 235, pl. vi. fig. 72.

This is a well-known Tertiary species, having been recorded from the London Clay, since d'Orbigny met with it in the Tertiary strata in the neighbourhood of Vienna. It is interesting to note that this species was also met with by Dr. Schwager in the Pliocene deposits of Kar Nicobar. *N. adolphina* does not appear to have been previously recorded from any deep-sea soundings.

Found in Sample No. 1, very rare; No. 6, very rare.

179. NODOSARIA (DENTALINA) SUBCANALICULATA (Neugeboren).

Nodosaria (Dentalina) subcanaliculata, Brady, 1884, Chall. Rep. vol. ix. p. 512, pl. lxiv. figs. 23, 24.

Recorded by Dr. Brady off Tahiti, 420 fathoms. It was also found fossil in the Miocene of Transylvania.

Found in Sample No. 5, very rare.

180. NODOSARIA (DENTALINA) INTERCELLULARIS ?, Brady.

Nodosaria (Dentalina) intercellularis ?, Brady, 1884, Chall. Rep. vol. ix. p. 515, pl. lxv. figs. 1–4.

A fragmentary specimen, possibly of this species, was found in Sample No. 5, very rare.

RHABDOGONIUM, Reuss.

181. RHABDOGONIUM TRICARINATUM (d'Orb.).

Rhabdogonium tricarinatum, Brady, 1884, Chall. Rep. vol. ix. p. 525, pl. lxvii. figs. 1–3.

Found in Sample No. 5, very rare.

MARGINULINA, d'Orbigny.

182. MARGINULINA GLABRA, d'Orbigny.

Marginulina glabra, Brady, 1884, Chall. Rep. vol. ix. p. 527, pl. lxv. figs. 5, 6.

CRISTELLARIA, Lamarck.

183. CRISTELLARIA ROTULATA (Lamarck).

Cristellaria rotulata, Brady, 1884, Chall. Rep. vol. ix. p. 547, pl. lxix. fig. 13 *a*, *b*.

Found in Sample No. 1, very rare; No. 2, very rare; No. 6, very rare.

184. CRISTELLARIA CULTRATA (Montfort).

Cristellaria cultrata, Brady, 1884, Chall. Rep. vol. ix. p. 550, pl. lxx. figs. 4–6.

Found in Sample No. 1, frequent; No. 2, rare; No. 6, very rare.

185. CRISTELLARIA ORBICULARIS (d'Orbigny).

Cristellaria orbicularis, Brady, 1884, Chall. Rep. vol. ix, p. 549, pl. lxix. fig. 17.

Found in Sample No. 3, very rare.

186. CRISTELLARIA RENIFORMIS, d'Orbigny.

Cristellaria reniformis, Brady, 1884, Chall. Rep. vol. ix. p. 539, pl. lxx. fig. 3 *a*, *b*.

Found in Sample No. 6, very rare.

187. CRISTELLARIA TENUIS (Bornemann).

Cristellaria tenuis, Brady, 1884, Chall. Rep. vol. ix. p. 535, pl. lxvi. figs. 21–23.

Found in Sample No. 1, very rare.

188. CRISTELLARIA OBTUSATA, Reuss, var. SUBALATA, Brady.

Cristellaria obtusata, var. *subalata*, Brady, 1884, Chall. Rep. vol. ix. p. 536, pl. lxvi. figs. 24, 25.

This variety was recorded by Dr. Brady from the N. Atlantic at depths from 130 to 630 fathoms.

Found in Sample No. 1, rare; No. 6, very rare.

189. CRISTELLARIA CREPIDULA (Fichtel & Moll).

Cristellaria crepidula, Brady, 1884, Chall. Rep. vol. ix. p. 542, pl. lxvii. figs. 17, 19, 20, pl. lxviii. figs. 1, 2.

Found in Sample No. 6, very rare.

POLYMORPHINA, d'Orbigny.

190. POLYMORPHINA ANGUSTA, Egger.

Polymorphina angusta, Brady, 1884, Chall. Rep. vol. ix. p. 563, pl. lxxii. figs. 1–3.

Found in Sample No. 1, very rare.

191. POLYMORPHINA OVATA, d'Orbigny.

Polymorphina ovata, Brady, 1884, Chall. Rep. vol. ix. p. 564, pl. lxxii. figs. 7, 8.

This form was found by Dr. Brady off Culebra Island at 390 fathoms.

Found in Sample No. 4, very rare; No. 6, very rare.

192. POLYMORPHINA FUSIFORMIS (Römer).

Globulina fusiformis, Römer, 1838, Neues Jahrb. f. Min. p. 386, pl. iii. fig. 37.

Polymorphina fusiformis, Brady, Parker, and Jones, 1870, Trans. Linn. Soc. Lond. vol. xxvii. p. 219, pl. xxxix. fig. 5 *a–c*, and woodcut *e*.

This species in its typical condition appears to have been hitherto unknown from deep-sea soundings, being previously recorded as a fossil form.

Found in Sample No. 6, very rare.

193. POLYMORPHINA COMMUNIS, d'Orbigny.

Polymorphina communis, Brady, 1884, Chall. Rep. vol. ix. p. 568, pl. lxxii. fig. 19.

Found in Sample No. 1, very rare.

194. POLYMORPHINA SORORIA, Reuss (Fistulose variety).

Polymorphina sororia, Brady, 1884, Chall. Rep. vol. ix. p. 562, pl. lxxiii. fig. 15.

Found in Sample No. 1, very rare.

UVIGERINA, d'Orbigny.

195. UVIGERINA INTERRUPTA, Brady.

Uvigerina interrupta, Brady, 1884, Chall. Rep. vol. ix. p. 580, pl. lxxv. figs. 12–14.

Found in Sample No. 1, very rare.

196. UVIGERINA TENUISTRIATA, Reuss.

Uvigerina tenuistriata, Brady, 1884, Chall. Rep. vol. ix. p. 574, pl. lxxiv. figs. 4–7.

Found in Sample No. 1, very rare; No. 2, rare; No. 5, very rare.

197. UVIGERINA PYGMÆA, d'Orbigny.

Uvigerina pygmæa, Brady, 1884, Chall. Rep. vol. ix. p. 575, pl. lxxiv. figs. 11–14.

Found in Sample No. 1, rare; No. 5, very rare.

198. UVIGERINA ACULEATA, d'Orbigny.

Uvigerina aculeata, Brady, 1884, Chall. Rep, vol. ix. p. 578, pl. lxxv. figs. 1, 2.

Found in Sample No. 1, common; No. 6, frequent.

199. UVIGERINA ANGULOSA, Williamson.

Uvigerina angulosa, Brady, 1884, Chall. Rep. vol. ix. p. 576, pl. lxxiv. figs. 15–18.

Found in Sample No. 2, rare; No. 5, rare.

200. UVIGERINA ANGULOSA, Williamson, var. SPINIPES, Brady.

Uvigerina angulosa, var. *spinipes*, Brady, 1884, Chall. Rep. vol. ix. p. 577, pl. lxxiv. figs. 19, 20.

This variety has been recorded by Dr. Brady from one locality only—Nightingale Island, Tristan d'Acunha, 100–150 fathoms.
Found in Sample No. 2, very rare.

201. UVIGERINA ASPERULA, Czjzek.

Uvigerina asperula, Brady, 1884, Chall. Rep. vol. ix. p. 578, pl. lxxv. figs. 6–8.

This form was figured by Dr. Schwager from the Pliocene deposits of Kar Nicobar under the name of *Uvigerina hispida*.
Found in Sample No. 2, very rare; No. 3, frequent; No. 4, very rare; No. 5, rare; No. 6, frequent.

202. UVIGERINA ASPERULA, Czjzek, var. AMPULLACEA, Brady.

Uvigerina asperula, var. *ampullacea*, Brady, 1884, Chall. Rep. vol. ix. p. 579, pl. lxxv. figs. 10, 11.

Found in Sample No. 5, rare; No. 6, very rare.

203. UVIGERINA SCHWAGERI, Brady.

Uvigerina schwageri, Brady, 1884, Chall. Rep. vol. ix. p. 575, pl. lxxiv. figs. 8–10.

This species was recorded by Dr. Brady from Kandavu, Fiji Islands, 210 fathoms; Raine Island, Torres Strait, 155 fathoms; and off the Philippine Islands, 95 fathoms.
Found in Sample No. 2, frequent.

204. UVIGERINA CANARIENSIS, d'Orbigny.

Uvigerina canariensis, Brady, 1884, Chall. Rep. vol. ix. p. 573, pl. lxxiv. figs. 1–3.

This species was obtained by Dr. Schwager from the Pliocene beds of Kar Nicobar, and figured under the name of *Uvigerina proboscidea.*

Found in Sample No. 2, very rare; No. 5, rare.

205. UVIGERINA BRUNNENSIS, Karrer.

Uvigerina brunnensis, Brady, 1884, Chall. Rep. vol. ix. p. 577, pl. lxxv. figs. 4, 5.

This form has before occurred off Christmas Harbour, Kerguelen Island, 120 fathoms; and on the western shores of Patagonia, 245 fathoms (Brady).

Found in Sample No. 4, very rare.

SAGRINA (d'Orbigny), Parker & Jones.

206. SAGRINA COLUMELLARIS, Brady.

Sagrina columellaris, Brady, 1884, Chall. Rep. vol. ix. p. 581, pl. lxxv. figs. 15–17.

Found in Sample No. 1, very rare.

RAMULINA, Rupert Jones.

(There is some probability of this organism belonging to a form of *Polymorphina.*)

207. RAMULINA GLOBULIFERA, Brady.

Ramulina globulifera, Brady, 1884, Chall. Rep. vol. ix. p. 587, pl. lxxvi. figs. 22–28.

Found in Sample No. 5, very rare.

GLOBIGERINA, d'Orbigny.

208. GLOBIGERINA BULLOIDES, d'Orbigny.

Globigerina bulloides, Brady, 1884, Chall. Rep. vol. ix. p. 593, pls. lxxvii., lxxix. figs. 3–7.

Found in Sample No. 1, common; No. 2, common; No. 4, frequent; No. 5, rare; No. 6, common.

209. GLOBIGERINA BULLOIDES, d'Orb., var. TRILOBA, Reuss.

Globigerina bulloides, var. *triloba*, Brady, 1884, Chall. Rep. vol. ix. p. 595, pl. lxxix. figs. 1, 2, pl. lxxxi. figs. 2, 3.

Found in Sample No. 2, very rare; No. 3, rare; No. 5, very rare; No. 6, very rare.

210. GLOBIGERINA DUBIA, Egger.

Globigerina dubia, Brady, 1884, Chall. Rep. vol. ix. p. 595, pl. lxxix. fig. 17 *a–c*.

Found in Sample No. 3, rare; No. 5, very rare; No. 6, very rare.

211. GLOBIGERINA RUBRA, d'Orbigny.

Globigerina rubra, Brady, 1884, Chall. Rep. vol. ix. p. 602, pl. lxxix. figs. 11–16.

Found in Sample No. 1, very rare; No. 2, rare; No. 4, rare; No. 6, rare.

212. GLOBIGERINA CRETACEA, d'Orbigny.

Globigerina cretacea, Brady, 1884, Chall. Rep. vol. ix. p. 596, pl. lxxxii. fig. 10 *a–c*.

Found in Sample No. 1, common; No. 2, common; No. 3, very rare; No. 4, frequent; No. 5, rare; No. 6, frequent.

213. GLOBIGERINA CONGLOBATA, Brady.

Globigerina conglobata, Brady, 1884, Chall. Rep. vol. ix. p. 603, pl. lxxx. figs. 1–5, pl. lxxxii. fig. 5.

Found in Sample No. 1, common; No. 2, common; No. 4, common; No. 5, rare; No. 6, frequent.

214. GLOBIGERINA ÆQUILATERALIS, Brady.

Globigerina æquilateralis, Brady, 1884, Chall. Rep. vol. ix. p. 605, pl. lxxx. figs. 18–21.

Found in Sample No. 1, very common; No. 2, rare; No. 3, very rare; No. 4, common; No. 5, rare; No. 6, common.

215. GLOBIGERINA SACCULIFERA, Brady.

Globigerina sacculifera, Brady, 1884, Chall. Rep. vol. ix. p. 604, pl. lxxx. figs. 11–17, pl. lxxxii. fig. 4.

Found in Sample No. 1, very common; No. 2, rare; No. 3, frequent; No. 4, common; No. 5, rare; No. 6, rare.

216. GLOBIGERINA DIGITATA, Brady.

Globigerina digitata, Brady, 1884, Chall. Rep. vol. ix. p. 599, pl. lxxx. figs. 6–10, pl. lxxxii. figs. 6, 7.

Dr. Brady states that this species was found at three stations in the South Atlantic and at six in the South Pacific, and also near the Ki Islands in the Eastern Archipelago at 580 fathoms, the latter place being the only one at which it was found in any abundance.

It is therefore interesting to note the occurrence of *G. digitata* in the Arabian Sea, where this fantastic species is common and in some instances remarkably developed.

Found in Sample No. 1, very common; No. 4, very common; No. 5, frequent; No. 6, very rare.

ORBULINA, d'Orbigny.

217. ORBULINA UNIVERSA, d'Orbigny.

Orbulina universa, Brady, Chall. Rep. vol. ix. p. 608, pl. lxxviii., pl. lxxxi. figs. 8–26, pl. lxxxii. figs. 1–3.

Found in Sample No. 1, very common; No. 3, rare; No. 4, common; No. 5, common; No. 6, very common.

HASTIGERINA, Wyv. Thomson.

218. HASTIGERINA PELAGICA (d'Orbigny).

Hastigerina pelagica, Brady, 1884, Chall. Rep. vol. ix. p. 613, pl. lxxxiii. figs. 1–8.

Found in Sample No. 6, very rare.

PULLENIA, Parker & Jones.

219. PULLENIA OBLIQUILOCULATA, Parker & Jones.

Pullenia obliquiloculata, Brady, 1884, Chall. Rep. vol. ix. p. 618, pl. lxxxiv. figs. 16–20.

Found in Sample No. 1, very common; No. 2, frequent; No. 3, rare; No. 4, common; No. 5, common; No. 6, frequent.

220. PULLENIA SPHÆROIDES (d'Orbigny).

Pullenia sphæroides, Brady, 1884, Chall. Rep. vol. ix. p. 615, pl. lxxxiv. figs. 12, 13.

Found in Sample No. 5, rare; No. 6, rare.

221. PULLENIA QUINQUELOBA, Reuss.

Pullenia quinqueloba, Brady, 1884, Chall. Rep. vol. ix. p. 617, pl. lxxxiv. figs. 14, 15.

Found in Sample No. 6, very rare.

SPHÆROIDINA, d'Orbigny.

222. SPHÆROIDINA BULLOIDES, d'Orbigny.

Sphæroidina bulloides, Brady, 1884, Chall. Rep. vol. ix. p. 620, pl. lxxxiv. figs. 1–7.

Found in Sample No. 1, very rare; No. 3, very rare; No. 4, rare; No. 6, rare.

223. SPHÆROIDINA DEHISCENS, Parker & Jones.

Globigerina seminulina, Schwager, 1866, Novara Exped., geol. Theil, vol. ii. p. 256, pl. vii. fig. 112.

Sphæroidina dehiscens, Brady, 1884, Chall. Rep. vol. ix. p. 621, pl. lxxxiv. figs. 8–11.

This species was recorded by Schwager from the Pliocene of Kar Nicobar under the name of *Globigerina seminulina*.

Found in Sample No. 1, common; No. 3, rare; No. 4, frequent; No. 6, rare.

CANDEINA, d'Orbigny.

224. CANDEINA NITIDA, d'Orbigny.

Candeina nitida, Brady, 1884, Chall. Rep. vol. ix. p. 622, pl. lxxxii. figs. 13–20.

Found in Sample No. 5, very rare.

CYMBALOPORA, Hagenow.

225. CYMBALOPORA POEYI (d'Orbigny).

Cymbalopora poeyi, Brady, 1884, Chall. Rep. vol. ix. p. 636, pl. cii. fig. 13 *a–c*.

Found in Sample No. 1, very rare; No. 2, rare.

226. CYMBALOPORA (TRETOMPHALUS) BULLOIDES (d'Orb.).

Cymbalopora (*Tretomphalus*) *bulloides*, Brady, Chall. Rep. vol. ix. p. 638, pl. cii. figs. 7–12.

Found in Sample No. 1, very rare.

DISCORBINA, Parker & Jones.

227. DISCORBINA VENTRICOSA, Brady.

Discorbina ventricosa, Brady, 1884, Chall. Rep. vol. ix. p. 654, pl. xci. fig. 7 *a–c*.

Found in Sample No. 1, very rare.

228. DISCORBINA PARISIENSIS (d'Orbigny).

Discorbina parisiensis, Brady, 1884, Chall. Rep. vol. ix. p. 648, pl. xc. figs. 5, 6, 9–12.

Found in Sample No. 1, very rare.

229. DISCORBINA ROSACEA (d'Orbigny).

Discorbina rosacea, Brady, 1884, Chall. Rep. vol. ix. p. 644, pl. lxxxvii. figs. 1, 4.

Found in Sample No. 5, very rare; No. 6, very rare.

230. DISCORBINA RUGOSA (d'Orbigny).

Discorbina rugosa, Brady, 1884, Chall. Rep. vol. ix. p. 652, pl. lxxxvii. fig. 3 *a–c*, pl. xci. fig. 4 *a–c*.

Found in Sample No. 6, rare.

PLANORBULINA, d'Orbigny.

231. PLANORBULINA ACERVALIS, Brady.

Planorbulina acervalis, Brady, 1884, Chall. Rep. vol. ix. p. 657, pl. xcii. fig. 4.

Of this species Dr. Brady remarks, "not uncommon amongst the Islands of the Pacific, in the Indian Ocean, and the Red Sea."

Found in Sample No. 1, very rare; No. 2, very rare.

232. PLANORBULINA LARVATA, Parker & Jones.

Planorbulina larvata, Brady, 1884, Chall. Rep. vol. ix. p. 658, pl. xcii. figs. 5, 6.

Found in Sample No. 6, very rare.

TRUNCATULINA, d'Orbigny.

233. TRUNCATULINA LOBATULA (Walker & Jacob).

Truncatulina lobatula, Brady, 1884, Chall. Rep. vol. ix. p. 660, pl. xcii. fig. 10, pl. xciii. figs. 1, 4, 5, pl. xcv. figs. 4, 5.

Found in Sample No. 1, rare; No. 5, very rare; No. 6, rare.

234. TRUNCATULINA WUELLERSTORFI (Schwager).

Anomalina wuellerstorfi, Schwager, 1866, Novara-Exped., geol. Theil, vol. ii. p. 258, pl. vii. figs. 105, 107.

Truncatulina wuellerstorfi, Brady, 1884, Chall. Rep. vol. ix. p. 662, pl. xciii. figs. 8, 9.

This species was originally described from fossil specimens from the Pliocene of Kar Nicobar.

Found in Sample No. 1, very common; No. 3, common; No. 4, common; No. 5, rare; No. 6, rare.

235. TRUNCATULINA PYGMÆA, Hantken.

Truncatulina pygmæa, Brady, 1884, Chall. Rep. vol. ix. p. 666, pl. xcv. figs. 9, 10.

Found in Sample No. 1, rare; No. 5, rare.

236. TRUNCATULINA UNGERIANA (d'Orbigny).

Truncatulina ungeriana, Brady, 1884, Chall. Rep. vol. ix. p. 664, pl. xciv. fig. 9 *a–c*.

Found in Sample No. 1, frequent; No. 2, rare; No. 3, rare; No. 4, common; No. 5, rare; No. 6, frequent.

237. TRUNCATULINA HAIDINGERII (d'Orbigny).

Truncatulina haidingerii, Brady, 1884, Chall. Rep. vol. ix. p. 663, pl. xcv. fig. 7 *a–c*.

Found in Sample No. 1, rare; No. 5, rare; No. 6, very rare.

238. TRUNCATULINA ROBERTSONIANA, Brady.

Truncatulina robertsoniana, Brady, 1884, Chall. Rep. vol. ix. p. 664, pl. xcv. fig. 4 *a–c*.

Found in Sample No. 1, rare; No. 6, very rare.

239. TRUNCATULINA DUTEMPLEI, d'Orbigny.

Truncatulina dutemplei, Brady, 1884, Chall. Rep. vol. ix. p. 665, pl. xcv. fig. 5 *a–c*.

Found in Sample No. 1, rare.

240. TRUNCATULINA PRÆCINCTA (Karrer).

Truncatulina præcincta, Brady, 1884, Chall. Rep. vol. ix. p. 667, pl. xcv. figs. 1–3.

This species affects the neighbourhood of coral-reefs and tropical areas; and occurs, amongst other places, in the Red Sea at 30 fathoms (Brady).

Found in Sample No. 2, rare.

241. TRUNCATULINA AKNERIANA (d'Orbigny).

Truncatulina akneriana, Brady, 1884, Chall. Rep. vol. ix. p. 663, pl. xciv. fig. 8 *a–c*.

Found in Sample No. 3, very rare.

242. TRUNCATULINA TENERA, Brady.

Truncatulina tenera, Brady, 1884, Chall. Rep. vol. ix. p. 665, pl. xcv. fig. 11 *a–c*.

Found in Sample No. 4, rare; No. 5, very rare; No. 6, very rare.

243. TRUNCATULINA CULTER (Parker & Jones).

Truncatulina culter, Brady, 1884, Chall. Rep. vol. ix. p. 668, pl. xcvi. fig. 3 *a–c*.

Anomalina bengalensis, Schwager, 1866, Novara-Exped., geol. Theil, vol. ii. p. 259, pl. vii. fig. 111.

This species was recorded under the latter name by Dr. Schwager from the Pliocene of Kar Nicobar.

Found in Sample No. 6, very rare.

ANOMALINA, d'Orbigny.

244. ANOMALINA GROSSERUGOSA (Gümbel).

Anomalina grosserugosa, Brady, 1884, Chall. Rep. vol. ix. p. 673, pl. xciv. figs. 4, 5.

Found in Sample No. 1, rare; No. 6, frequent.

245. ANOMALINA POLYMORPHA, Costa.

Anomalina polymorpha, Brady, 1884, Chall. Rep. vol. ix. p. 676, pl. xcvii. figs. 3–7.

Found in Sample No. 2, very rare.

PULVINULINA, Parker & Jones.

246. PULVINULINA REPANDA (F. & M.), var. CONCAMERATA, (Montagu).

Pulvinulina repanda, var. *concamerata*, Brady, 1884, Chall. Rep. vol. ix. p. 685, pl. civ. fig. 19 *a–c*.

Found in Sample No. 1, very rare.

247. PULVINULINA ELEGANS (d'Orbigny).

Pulvinulina elegans, Brady, 1884, Chall. Rep. vol. ix. p. 699, pl. cv. figs. 4–6.

One of the specimens found has a carinate edge similar to that in fig. 6 in the 'Challenger' Report.

Found in Sample No. 1, common; No. 3, frequent; No. 4, very common; No. 5, very common; No. 6, common.

248. PULVINULINA PARTSCHIANA (d'Orbigny).

Pulvinulina partschiana, Brady, 1884, Chall. Rep. vol. ix. p. 699, pl. cv. fig. 3 *a–c*, woodcut fig. 21.

This form, which represents the deep-water variety of *P. elegans*, is, as might be supposed, not well-represented in these soundings, as regards well-defined specimens, though transitional forms are frequent.

Found in Sample No. 1, rare; No. 4, rare; No. 5, rare; No. 6, rare.

249. PULVINULINA MENARDII (d'Orbigny).

Pulvinulina menardii, Brady, 1884, Chall. Rep. vol. ix. p. 690, pl. ciii. figs. 1, 2.

Found in Sample No. 1, very common; No. 2, common; No. 4, common; No. 5, frequent; No. 6, common.

250. PULVINULINA MENARDII (d'Orb.), var. FIMBRIATA, Brady.

Pulvinulina menardii, var. *fimbriata*, Brady, 1884, Chall. Rep. vol. ix. p. 691, pl. ciii. fig. 3 *a, b*.

Found in Sample No. 1, very rare; No. 4, rare.

251. PULVINULINA CANARIENSIS (d'Orbigny).

Pulvinulina canariensis, Brady, 1884, Chall. Rep. vol. ix. p. 692, pl. ciii. figs. 8–10.

Found in Sample No. 1, rare; No. 5, very rare; No. 6, rare.

252. PULVINULINA TUMIDA, Brady.

Pulvinulina tumida, Brady, 1884, Chall. Rep. vol. ix. p. 692, pl. ciii. figs. 4–6.

Found in Sample No. 1, frequent; No. 4, rare; No. 6, frequent.

253. PULVINULINA MICHELINIANA (d'Orbigny).

Pulvinulina micheliniana, Brady, 1884, Chall. Rep. vol. ix. p. 694, pl. civ. figs. 1, 2.

Found in Sample No. 1, rare; No. 3, common; No. 6, very rare.

254. PULVINULINA PAUPERATA, Parker & Jones.

Pulvinulina pauperata, Brady, 1884, Chall. Rep. vol. ix. p. 696, pl. civ. figs. 3–11.

The specimens from the Arabian Sea are extremely fine and characteristic.

Found in Sample No. 1, rare; No. 3, rare; No. 4, frequent; No. 6, rare.

255. PULVINULINA AURICULA (Fichtel & Moll).

Pulvinulina auricula, Brady, 1884, Chall. Rep. vol. ix. p. 688, pl. cvi. fig. 5 *a–c*.

Found in Sample No. 1, rare; No. 2, very rare.

256. PULVINULINA OBLONGA (Williamson).

Pulvinulina oblonga, Brady, 1884, Chall. Rep. vol. ix. p. 688, pl. cvi. fig. 4 *a–c*.

Found in Sample No. 1, rare.

257. PULVINULINA PUNCTULATA (d'Orbigny).

Pulvinulina punctulata, Brady, 1884. Chall. Rep. vol. ix. p. 685, pl. civ. fig. 17 *a–c*.

Found in Sample No. 1, very rare.

258. PULVINULINA EXIGUA, Brady.

Pulvinulina exigua, Brady, 1884, Chall. Rep. vol. ix. p. 696, pl. ciii. figs. 13, 14.

Found in Sample No. 2, very rare; No. 5, very rare; No. 6, very rare.

259. PULVINULINA KARSTENI (Reuss).

Pulvinulina karsteni, Brady, 1884, Chall. Rep. vol. ix. p. 698, pl. cv. figs. 8, 9.

ROTALIA, Lamarck.

260. ROTALIA ORBICULARIS, d'Orbigny.

Rotalia orbicularis, Brady, 1884, Chall. Rep. vol. ix. p. 706, pl. cvii. fig. 5, pl. cxv. fig. 6.

Found in Sample No. 1, very rare; No. 5, rare; No. 6, very rare.

261. ROTALIA CALCAR (d'Orbigny).

Rotalia calcar, Brady, 1884, Chall. Rep. vol. ix. p. 709, pl. cviii. figs. 3, 4?

Found in Sample No. 1, common.

262. ROTALIA SOLDANII, d'Orbigny.

Rotalia soldanii, Brady, 1884, Chall. Rep. vol. ix. p. 706, pl. cvii. figs. 6, 7.

Found in Sample No. 1, common; No. 3, rare; No. 4, rare; No. 5, rare; No. 6, frequent.

263. ROTALIA BROECKHIANA, Karrer.

Rotalia broeckhiana, Brady, 1884, Chall. Rep. vol. ix. p. 705, pl. cvii. fig. 4 *a–c*.

This species has previously been recorded off the Ki Islands, at a depth of 580 fathoms (Brady).

Found in Sample No. 3, very rare; No. 5, very rare; No. 6, common.

CALCARINA, d'Orbigny.

264. CALCARINA HISPIDA, Brady.

Calcarina hispida, Brady, 1884, Chall. Rep. vol. ix. p. 713, pl. cviii. figs. 8, 9.

Found in Sample No. 2, rare.

265. CALCARINA NICOBARENSIS, Schwager.

Calcarina nicobarensis, Schwager, 1866, Novara-Exped., geol. Theil, vol. ii. p. 261, pl. vii. fig. 114, and fig. 3 (shell-section).

This species was described by Dr. Schwager from the Pliocene beds of Kar Nicobar, and is here recorded for the first time as a recent form from the Arabian Sea.

Found in Sample No. 1, very common; No. 2, rare.

266. CALCARINA DEFRANCEI, d'Orbigny.

Calcarina defrancei, Brady, 1884, Chall. Rep. vol. ix. p. 714, pl. cviii. fig. 6 *a–c*.

Found in Sample No. 1, very rare.

GYPSINA, Carter.

267. GYPSINA GLOBULUS (Reuss).

Gypsina globulus, Brady, 1884, Chall. Rep. vol. ix. p. 717, pl. ci. fig. 8.

This species was found in the coral-sands of Sample No. 2, very rare.

POLYTREMA, Risso.

268. POLYTREMA MINIACEUM (Linné).

Polytrema miniaceum, Brady, 1884, Chall. Rep. vol. ix. p. 721, pl. c. figs. 5–9, pl. ci. fig. 1.

Found in Sample No. 1, rare.

NONIONINA, d'Orbigny.

269. NONIONINA UMBILICATULA (Montagu).

Nonionina umbilicatula, Brady, 1884, Chall. Rep. vol. ix. p. 726, pl. cix. figs. 8, 9.

Found in Sample No. 1, rare; No. 5, frequent; No. 6, rare.

270. **NONIONINA POMPILIOIDES** (Fichtel & Moll).

Nonionina pompilioides, Brady, 1884, Chall. Rep. vol. ix. p. 727, pl. cix. figs. 10, 11.

Found in Sample No. 1, very rare; No. 5, very rare; No. 6, rare.

POLYSTOMELLA, Lamarck.

271. **POLYSTOMELLA CRISPA** (Linné).

Polystomella crispa, Brady, 1884, Chall. Rep. vol. ix. p. 736, pl. cx. figs. 6, 7.

Found in Sample No. 1, rare; No. 2, very rare.

AMPHISTEGINA, d'Orbigny.

272. **AMPHISTEGINA LESSONII**, d'Orbigny.

Amphistegina lessonii, Brady, 1884, Chall. Rep. vol. ix. p. 740, pl. cxi. figs. 1–7.

Found in Sample No. 1, frequent; No. 2, common; No. 4, rare.

273. **AMPHISTEGINA RADIATA** (Fichtel & Moll). (Plate I. figs. 8, 9, 10, 12.)

Nautilus radiatus, Fichtel & Moll, 1803, Test. Micr. p. 58, pl. viii. figs. *a–d*.

The above species was described by Fichtel and Moll from specimens found in sea-sand from the interior of shells from the Red Sea.

Profs. Parker and Jones remark[1] on this form as follows:—

"This is a small, smooth, lenticular *Nummulina*, about 1 line in diameter; marked with twenty-four radiating, translucent, septal lines, slightly sinuous, with an open sigmoid flexure, which extends from the periphery to the umbonal centre, and as many intermediate, short, parallel septal lines towards the peripherical margin. These indicate altogether nearly fifty chambers in the outer whorl, the lateral lobes of which, in passing towards the umbonal centre, interfere with each other, leaving only indications of half as many elongate, triangular, sinuous, umbilical lobes."

Having this opportunity of examining the very fine specimens referable to the above species, which were found in the above-mentioned (no. 2) coral-deposits of the Laccadives, I prepared slices of the tests, both median and transverse, in the hope of finding additional evidence regarding the affinities of the species. This was considered necessary, especially since the recent examples of *Nummulina* appear to have been hitherto somewhat neglected.

In the first place, the specimens of *Amphistegina radiata* which occur in the Laccadive Island deposits are inequilateral in transverse section, the umbonal centre being more prominent on one side than the other. This fact points to the tendency of this species to increase in an oblique or turbinoid spiral, such as is shown in all undoubted *Amphistegina* and not on the Nummuline plan. I venture to suggest that the peripheral figure of this form, as originally given by Fichtel and Moll[1], is too symmetrically drawn, and it is easy to conceive how such a slight degree of asymmetry would be overlooked without the accompaniment of carefully prepared sections of the test.

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[1] "The Nomenclature of the Foraminifera, Part III.," Ann. & Mag. Nat. Hist. ser. 3, vol. v. [1860] pp. 105, 106.

Another feature, moreover, brought out in the transverse sections of the test, and which helps to strengthen the evidence in favour of this form belonging to the genus *Amphistegina*, is the existence of the characteristic double cone-shaped non-tubulate portions of the test which form its central axis in transverse section (see Plate I. fig. 9).

Whilst examining the median sections of *A. radiata*, the presence of true interseptal canals with many branchlets was detected (see fig. 10). In his 'Introduction to the Study of the Foraminifera,' Dr. Carpenter describes the various characters which distinguish forms of the genus *Amphistegina*, and of which a summary and comparison with the Rotaline type is given at p. 246. Here it is remarked that the "singleness of the septal lamellæ is a most important additional link of affinity" to the group of the Rotalines. This statement, which may have been made through the examination of non-typical specimens, caused me some doubt as to the validity of the claim of *A. radiata* to the Amphistegine group. Upon preparing sections of typical specimens of *Amphistegina hauerina* from the Vienna Basin, which I possess through the kindness of Professor T. Rupert Jones, I found the same well-developed canal-system existing in the fossil forms (see fig. 11), of the true position of which as *Amphistegina* there can be no question, as were seen in the recent specimens of *A. radiata*.

Therefore that apparently serious objection was satisfactorily removed, and, at the same time, additional facts were obtained, which show that, as far as the shell-structure is concerned, *Amphistegina* is as highly advanced in differential characters as is the shell of *Nummulina*. The only difference therefore that appears to exist between ordinary *Amphistegina* of the *A. lessonii* type (including *A. hauerina*) and the recent *A. radiata* is the remarkable modification of the segments in the former type of the outer layer on the inferior side of the test giving rise to the "astral lobes."

The transverse sections of the *Amphistegina* generally, if taken accurately through the middle of the shell, exhibit the large spherical primordial chamber with the succeeding more or less ovoid one. I especially mention this fact since several examples of the young tests of *A. radiata* have occurred in the peripheral whorls of adult specimens of that species, and are seen in both median and transverse sections of the tests (see fig. 12). In all cases those observed consisted of two chambers, and they are exactly comparable in shape with the early chambers of the adult specimens, which, by the way, belong to the megalospheric type of growth.

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[1] *Op. cit.* pl. viii. fig. *d*.

In a paper on "L'*Amphistegina* del calcare lenticolare di Parlascio"[1], Dr. G. A. de Amicis described a form of *Amphistegina* formerly named *Nummulites targionii* by Professor Meneghini, but which is shown by Dr. de Amicis to be a true *Amphistegina*. It appears to approach very closely in its general characters to *A. radiata*, which it especially resembles in the subdivision of the peripheral margins of the successive layers seen in transverse section[2].

The specimens of *A. radiata* found in the Arabian Sea average $\frac{1}{8}$ of an inch in diameter, and are thus somewhat larger than the specimens originally described by Fichtel and Moll. The usual number of principal septa appearing on the surface of full-grown individuals is from eighteen to twenty, and these septa often show a tendency to bifurcate towards the periphery. The surface of the test is tolerably smooth, and the septal lines are marked out in clear transparent shell-matter, while the rest of the test is of a creamy-white colour.

Incidentally I may mention that although the form which has been referred to as *Nummulina cumingii* by Drs. Carpenter and Brady has not occurred in these deposits, I have no doubt that, as Professor Rupert Jones has already suggested to me, that species is more properly referable to the "*Nautilus venosus*" of Fichtel and Moll, and should perhaps stand as *Nummulina venosa* (F. & M.). It is open to some question, however, whether it is a truly Nummuline form, since some published drawings of the species show a decidedly inequilateral growth, and in point of fact a series of specimens may show all gradations into *Operculina*.

Amphistegina radiata was found only in Sample No. 2, in which it was common.

OPERCULINA, d'Orbigny.

274. OPERCULINA COMPLANATA (Defrance).

Lenticulites complanata, Defrance, 1822, Dict. Sci. Nat. vol. xxv. p. 453.

Operculina arabica, Carter, 1853, Journ. Roy. Asiatic Soc., Bombay Branch, vol. iv. p. 437, pl. xviii.

Operculina complanata, Brady, 1884, Chall. Rep. vol. ix. p. 743, pl. cxii. figs. 3–5, 8.

The above species was described under the name of *O. arabica* by H. J. Carter, who obtained his specimens off the south-east coast of Arabia.

Found in Sample No. 1, frequent.

[1] 1885. Processi verbali della Società Toscana di Scienze Naturali.

[2] See also De Amicis, 1886, "Il Calcare ad *Amphistegina* nella Provincia di Pisa," Atti Soc. Toscana Sci. Nat., Memorie, vol. vii. pl. xi. figs. 1, 3, 6, 7.

275. **Operculina complanata** (Defr.), var. **granulosa**, Leymerie.

Operculina complanata, var. *granulosa*, Brady, 1884, Chall. Rep. vol. ix. p. 743, pl. cxii. figs. 6, 7, 9, 10.

Found in Sample No. 2, rare.

Heterostegina, d'Orbigny.

276. **Heterostegina depressa**, d'Orbigny.

Heterostegina depressa, Brady, 1884, Chall. Rep. vol. ix. p. 746, pl. cxii. figs. 14–20.

Found in Sample No. 1, very rare; No. 2, frequent.

Cycloclypeus, Carpenter.

277. **Cycloclypeus guembelianus**, Brady.

Cycloclypeus guembelianus, Brady, 1884, Chall. Rep. vol. ix. p. 751, pl. cxi. fig. 8 *a*, *b*.

This species has been previously found off Kandavu, Fiji Islands, at 210 fathoms.

Found in Sample No. 1, very rare.

Species and Varieties.	Samples.					
	1.	2.	3.	4.	5.	6.
Family MILIOLIDÆ.						
Subfamily Nubeculariinæ.						
1. Nubecularia lucifuga, *Defrance*	v. r.					
Subfamily Miliolininæ.						
2. Biloculina depressa, *d'Orbigny*	c.	...	f.	c.	r.	f.
3. ,, ,, var. murrhyna, *Schw.*	f.	...	...	f.	...	r.
4. ,, ,, var. serrata, *Brady*	r.	...	v. r.	...	...	r.
5. ,, tubulosa, *Costa*	f.	...	r.	c.	v. r.	f.
6. ,, ringens (*Lam.*)	...	...	...	...	...	v. r.
7. ,, ,, var. striolata, *Brady*	...	...	v. r.	v. r.	...	r.
8. ,, comata, *Brady*	...	...	...	...	...	v. r.
9. Spiroloculina robusta, *Brady*	f.					
10. ,, antillarum, *d'Orb.*	r.					
11. ,, limbata, *d'Orb.*	v. r.					
12. ,, grata, *Terquem*	v. r.	f.				
13. ,, arenaria, *Brady*	...	...	...	r.		
14. ,, asperula, *Karrer*	...	...	...	r.		
15. Miliolina trigonula (*Lam.*)	...	...	...	...	...	v. r.
16. ,, insignis, *Brady*	...	v. r.				
17. ,, tricarinata (*d'Orb.*)	f.	v . r.	...	...	r.	
18. ,, circularis (*Bornemann*)	v. r.					
19. ,, auberiana (*d'Orb.*)	r.	...	...	r.	v. r.	
20. ,, cuvieriana (*d'Orb.*)	...	...	...	...	v. r.	v. r.
21. ,, venusta (*Karrer*)	r.					

Species and Varieties.	Samples.					
	1.	2.	3.	4.	5.	6.
22. Miliolina gracilis (*d'Orb.*)	v. r.					
23. ,, amygdaloides, *Brady*	v. r.					
24. ,, bicornis (*W. & J.*)	v. r.					
25. ,, schreibersiana (*d'Orb.*)	...	v. r.				
26. ,, undosa (*Karrer*)	f.					
27. ,, linnæana (*d'Orb.*)	v. r.					
28. ,, reticulata (*d'Orb.*)	f.					
29. ,, parkeri, *Brady*	v. r.					
30. ,, rupertiana, *Brady*	v. r.					
Subfamily HAUERININÆ.						
31. Ophthalmidium inconstans, *Brady*	v. r.					
32. Sigmoïlina sigmoidea (*Brady*)	v. r.					
33. ,, celata (*Costa*)	c.	...	r.	r.	r.	r.
Subfamily PENEROPLIDINÆ.						
34. Cornuspira carinata (*Costa*)	v. r.					
35. Orbitolites complanata, *Lam.*	c.					
36. ,, marginalis (*Lam.*)	r.					
Subfamily ALVEOLININÆ.						
37. Alveolina melo (*F. & M.*)	v. r.					
38. ,, boscii (*Defr.*)	c.	r.				
Family ASTRORHIZIDÆ.						
Subfamily PILULININÆ.						
39. Technitella melo, *Norman*	...	...	...	v. r.		
40. ,, raphanus, *Brady*	...	...	...	f.		
41. Bathysiphon filiformis, *M. Sars*	...	...	...	v. r.		
Subfamily SACCAMMININÆ.						
42. Psammosphæra fusca, *Schulze*	v. r.					
43. Saccammina sphærica, *M. Sars*	r.					
44. ,, socialis, *Brady*	...	...	...	...	v. r.	
Subfamily RHABDAMMININÆ.						
45. Hyperammina elongata, *Brady*	r.	...	...	c.	v. r.	r.
46. ,, ramosa, *Brady*	f.	...	r.	v. c.	...	r.
47. ,, arborescens (*Norman*)	r.	...	...	v. r.		
48. Marsipella elongata, *Norman*	...	...	...	r.		
49. Rhabdammina discreta, *Brady*	v. r.	...	...	f.	...	v. r.
50. Rhizammina indivisa, *Brady*	v. r.	...	...	c.	v. r.	
Family LITUOLIDÆ.						
Subfamily LITUOLINÆ.						
51. Reophax difflugiformis, *Brady*	v. r.	...	...	v. r.	v. r.	v. r.
52. ,, scorpiurus, *Montfort*	v. r.	...	...	f.	...	f.
53. ,, spiculifera, *Brady*	r.	...	...	v. r.	...	v. r.
54. ,, distans, *Brady*	...	...	...	v. r.		
55. ,, nodulosa, *Brady*	f.	...	...	...	...	v. r.
56. ,, dentaliniformis, *Brady*	r.	...	v. r.	v. r.	v. r.	
57. ,, bacillaris, *Brady*	v. r.					
58. ,, pilulifera, *Brady*	c.					

Species and Varieties.	Samples.					
	1.	2.	3.	4.	5.	6.
59. Haplophragmium glomeratum, *Brady*	...	...	...	...	...	r.
60. „ latidorsatum (*Bornemann*)	r.	...	...	c.	...	v. r.
61. „ globigeriniforme (*P. & J.*)	r.	...	...	...	...	r.
62. „ canariense (*d'Orb.*)	v. r.	...	...	v. r.	...	r.
63. „ turbinatum, *Brady*	v. r.	...	...	v. r.	...	v. r.
64. „ rotulatum, *Brady*	v. r.	...	...	r.	...	v. r.
65. „ scitulum, *Brady*	r.	...	...	...	v. r.	r.
66. „ emaciatum, *Brady*	...	...	...	...	v. r.	
67. „ agglutinans (*d'Orb.*)	v. r.					
68. „ truncatuliniforme, sp. nov.	...	...	...	...	...	v. r.
69. Placopsilina cenomana, *d'Orb.*	...	...	...	...	...	v. r.
Subfamily Trochammininæ.						
70. Thurammina papillata, *Brady*	...	...	...	r.		
71. Hormosina carpenteri, *Brady*	v. r.	...	...	c.	...	f.
72. „ ovicula, *Brady*	v. r.					
73. „ globulifera, *Brady*	...	...	...	...	...	v. r.
74. Ammodiscus incertus (*d'Orb.*)	r.	...	...	r.	...	v. r.
75. „ tenuis, *Brady*	...	...	...	...	...	v. r.
76. „ charoides (*J. & P.*)	v. r.					
77. Trochammina trulissata, *Brady*	f.	...	...	f.	...	r.
78. Webbina clavata, *J. & P.*	...	...	...	f.	...	v. r.
Subfamily Loftusinæ.						
79. Cyclammina pusilla, *Brady*	r.	...	v. r.	f.	...	r.
80. „ cancellata, *Brady*	...	...	...	...	...	r.
Family TEXTULARIIDÆ.						
Subfamily Textulariinæ.						
81. Textularia sagittula, *Defrance*	...	...	...	r.	v. r.	v. r.
82. „ „ var. fistulosa, *Brady.*	r.					
83. „ gramen, *d'Orb.*	f.					
84. „ lythostrotum (*Schwager*)	f.	v. r.	...	r.	...	c.
85. „ conica, *d'Orb.*	...	...	...	...	...	v. r.
86. „ agglutinans, *d'Orb.*	r.	...	...	...	...	c.
87. Verneuilina pygmæa (*Egger*)	f.	...	...	r.		
88. „ propinqua, *Brady*	v. r.	...	...	r.		
89. Chrysalidina dimorpha, *Brady*	...	r.	...	...	v. r.	
90. Gaudryina pupoides, *d'Orb.*	r.	...	...	v. r.	...	v. r.
91. „ rugosa, *d'Orb.*	f.	...	r.	c.	...	f.
92. „ subrotundata, *Schwager*	c.	...	...	f.	...	c.
93. „ baccata, *Schwager*	...	v. r.				
94. „ siphonella, *Reuss*	...	...	...	...	v. r.	v. r.
95. Valvulina conica, *P. & J.*	r.	...	...	...	...	v. r.
96. Clavulina communis, *d'Orb.*	f.	...	f.	c.	r.	r.
97. „ parisiensis, *d'Orb.*	v. r.					
98. „ angularis, *d'Orb.*	r.					
Subfamily Buliminінæ.						
99. Bulimina ovata, *d'Orb.*	f.	...	...	r.	v. r.	
100. „ pyrula, *d'Orb.*	f.	...	r.	...	v. r.	

Species and Varieties.	Samples.					
	1.	2.	3.	4.	5.	6.
101. Bulimina elongata, *d'Orb.*	v. r.					
102. ,, pupoides, *d'Orb.*	v. r.	...	v. r.			
103. ,, affinis, *d'Orb.*	r.					
104. ,, elegans, *d'Orb.*	v. r.					
105. ,, subcylindrica, *Brady*	r.					
106. ,, declivis, *Reuss*	v. r.					
107. ,, contraria (*Reuss*)	f.	...	...	r.	v. r.	f.
108. ,, aculeata, *d'Orb.*	v. c.	...	r.	...	f.	v. r.
109. ,, buchiana, *d'Orb.*	v. r.	...	...	v. r.	v. r.	
110. ,, inflata, *Seguenza*	v. r.	...	...	...	...	v. r.
111. ,, subornata, *Brady*	...	v. r.	...	...	v. r.	
112. ,, rostrata, *Brady*	...	...	...	...	r.	
113. Virgulina schreibersiana, *Czjzek*	v. r.	...	...	...	v. r.	
114. ,, subsquamosa, *Egger*	r.					
115. ,, subdepressa, *Brady*	...	...	...	...	v. r.	
116. Bolivina punctata, *d'Orb.*	v. r.					
117. ,, textilarioides, *Reuss*	...	...	...	...	v. r.	
118. ,, limbata, *Brady*	v. r.	...	...	...	v. r.	
119. ,, nobilis, *Hantken*	v. r.	...	...	...	r.	
120. ,, beyrichi, *Reuss*	v. r.					
121. ,, obsoleta, *Eley*	r.	...	...	...	v. r.	
122. ,, robusta, *Brady*	...	...	...	...	v. r.	
123. ,, arenosa, sp. nov.	v. r.					
124. Pleurostomella subnodosa, *Reuss*	r.					
125. ,, alternans, *Schwager*	...	...	...	...	...	r.
Subfamily CASSIDULININÆ.						
126. Cassidulina murrhyna (*Schwager*)	...	...	v. r.	f.	v. r.	f.
127. ,, calabra (*Seguenza*)	...	...	...	...	r.	c.
128. ,, subglobosa, *Brady*	v. r.					
129. ,, bradyi, *Norman*	r.					
130. ,, parkeriana, *Brady*	...	...	...	...	...	v. r.
131. ,, lævigata, *d'Orb.*	r.	...	...	...	v. r.	
132. Ehrenbergina serrata, *Reuss*	r.	f.	...	...	f.	
Family CHILOSTOMELLIDÆ.						
133. Chilostomella ovoidea, *Reuss*	r.	...	v. r.			
134. Allomorphina trigona, *Reuss*	...	...	...	...	...	v. r.
Family LAGENIDÆ.						
Subfamily LAGENINÆ.						
135. Lagena lævis (*Mont.*)	r.					
136. ,, globosa (*Mont.*)	...	...	...	...	...	v. r.
137. ,, apiculata, *Reuss*	r.					
138. ,, distoma, *P. & J.*	v. r.					
139. ,, hispida, *Reuss*	v. r.					
140. ,, aspera, *Reuss*, var. spinifera, nov.	...	...	...	v. r.		
141. ,, sulcata (*W. & J.*)	...	...	...	...	...	v. r.
142. ,, gracilis, *Will.*	v. r.	...	...	...	v. r.	
143. ,, feildeniana, *Brady*	...	...	v. r.			
144. ,, desmophora, *O. Ry. Jones*	r.	...	v. r.	...	v. r.	
145. ,, hexagona (*Will.*)	r.					
146. ,, marginata (*W. & J.*)	...	...	...	v. r.	r.	v. r.
147. ,, ,, var. catenulosa, nov.	...	...	...	...	...	v. r.

Species and Varieties.	Samples.					
	1.	2.	3.	4.	5.	6.
148. Lagena seminiformis, *Schwager*	...	...	...	...	v. r.	
149. „ lagenoides (*Will.*)	...	...	...	...	v. r.	
150. „ capillosa (*Schwager*)	...	...	...	...	...	v. r.
151. „ fimbriata, *Brady*	v. r.					
152. „ castrensis, *Schwager*	v. r.	...	...	...	r.	
153. „ staphyllearia (*Schwager*)	v. r.					
154. „ alveolata, var. substriata, *Brady*	v. r.	...	...	...	...	v. r.
155. „ quadricostulata, *Reuss*	v. r.	...	...	...	...	v. r.
156. „ lævigata (*Reuss*)	v. r.					
157. „ orbignyana (*Seguenza*)	r.	...	...	...	r.	f.
158. „ formosa, *Schwager*	r.	...	...	...	...	v. r.
159. „ trigono-ornata, *Brady*	r.					
160. „ quadralata, *Brady*	v. r.					
161. Nodosaria (Dentalina) calomorpha, *Rss.*	...	...	...	...	r.	
162. „ radicula (*L.*)	r.	...	...	...	...	r.
163. „ pyrula, *d'Orb.*	v. r.	...	...	...	v. r.	
164. „ (D.) farcimen, *Reuss*	v. r.					
165. „ (D.) filiformis (*d'Orb.*)	v. r.					
166. „ (D.) roemeri (*Neugeboren*)	r.	...	...	v. r.		
167. „ (D.) communis, *d'Orb.*	c.	...	v. r.	...	r.	r.
168. „ (D.) consobrina (*d'Orb.*)	r.	v. r.				
169. „ (D.) inflexa, *Reuss*	...	...	...	...	r.	
170. „ ovulata, *Sherborn & Chapman*	...	...	...	...	r.	
171. „ (D.) soluta, *Reuss*	...	...	...	v. r.	...	r.
172. „ (D.) „ var. subaculeata, nov.	r.	...	v. r.	r.	v. r.	
173. „ (D.) acicula (*Lam.*)	...	...	...	...	...	v. r.
174. „ scalaris (*Batsch*)	v. r.					
175. „ „ var. separans, *Brady*	v. r.					
176. „ (D.) obliqua (*L.*)	v. r.					
177. „ raphanus (*L.*)	v. r.	...	...	...	r.	
178. „ (D.) adolphina (*d'Orb.*)	v. r.	...	...	...	...	v. r.
179. „ (D.) subcanaliculata (*Neug.*)	...	...	...	...	v. r.	
180. „ (D.) intercellularis (?), *Brady*	...	...	...	...	v. r.	
181. Rhabdogonium tricarinatum (*d'Orb.*)	...	...	...	...	v. r.	
182. Marginulina glabra, *d'Orb.*	v. r.	...	...	...	v. r.	
183. Cristellaria rotulata (*Lam.*)	v. r.	v. r.	...	...	...	v. r.
184. „ cultrata (*Montf.*)	f.	r.	...	...	...	v. r.
185. „ orbicularis (*d'Orb.*)	...	...	v. r.			
186. „ reniformis, *d'Orb.*	...	...	...	...	...	v. r.
187. „ tenuis (*Bornem.*)	v. r.					
188. „ obtusata, *Reuss*, var. subalata, *Brady*	r.	...	...	...	...	v. r.
189. „ crepidula (*F. & M.*)	...	...	...	...	...	v. r.
Subfamily POLYMORPHININÆ.						
190. Polymorphina angusta, *Egger*	v. r.					
191. „ ovata, *d'Orb.*	...	...	...	v. r.	...	v. r.
192. „ fusiformis (*Römer*)	...	...	...	...	...	v. r.
193. „ communis, *d'Orb.*	v. r.					
194. „ sororia, *Reuss* (fistulose var.)	v. r.					
195. Uvigerina interrupta, *Brady*	v. r.					
196. „ tenuistriata, *Reuss*	v. r.	r.	...	...	v. r.	
197. „ pygmæa, *d'Orb.*	r.	...	...	...	v. r.	

Species and Varieties.	Samples.					
	1.	2.	3.	4.	5.	6.
198. Uvigerina aculeata, *d'Orb.*	c.	...	...	...	...	f.
199. „ angulosa, *Will.*	...	r.	...	...	r.	
200. „ „ var. spinipes, *Brady.*	...	v. r.				
201. „ asperula, *Czjzek*	...	v r.	f.	v. r.	r.	f.
202. „ „ var. ampullacea, *Brady*	...	...	...	...	r.	v. r.
203. „ schwageri, *Brady*	...	f.				
204. „ canariensis, *d'Orb.*	...	v. r.	...	...	r.	
205. „ brunnensis, *Karrer*	...	...	...	v. r.		
206. Sagrina columellaris, *Brady*	v. r.					
207. Ramulina globulifera, *Brady*	...	...	...	...	v. r.	
Family GLOBIGERINIDÆ.						
208. Globigerina bulloides, *d'Orb.*	c.	c.	...	f.	r.	c.
209. „ „ var. triloba, *Reuss.*	...	v. r.	r.	...	v. r.	r.
210. „ dubia, *Egger*	...	...	r.	...	v. r.	v. r.
211. „ rubra, *d'Orb.*	v. r.	r.	...	r.	...	r.
212. „ cretacea, *d'Orb.*	c.	c.	v. r.	f.	r.	f.
213. „ conglobata, *Brady*	c.	c.	...	c.	r.	f.
214. „ æquilateralis, *Brady*	v. c.	r.	v. r.	c.	r.	c.
215. „ sacculifera, *Brady*	v. c.	r.	f.	c.	r.	r.
216. „ digitata, *Brady*	v. c.	...	...	v. c.	f.	v. r.
217. Orbulina universa, *d'Orb.*	v. c.	...	r.	c.	c.	v. c.
218. Hastigerina pelagica (*d'Orb.*)	...	...	...	...	...	v. r.
219. Pullenia obliquiloculata, *P. & J.*	v. c.	f.	r.	c.	c.	f.
220. „ sphæroides (*d'Orb.*)	...	...	...	...	r.	r.
221. „ quinqueloba, *Reuss*	...	...	...	...	...	v. r.
222. Sphæroidina bulloides, *d'Orb.*	v. r.	...	v. r.	r.	...	r.
223. „ dehiscens, *P. & J.*	c.	...	r.	f.	...	r.
224. Candeina nitida, *d'Orb.*	...	...	...	...	v. r.	
Family ROTALIIDÆ.						
Subfamily ROTALIINÆ.						
225. Cymbalopora poeyi (*d'Orb.*)	v. r.	r.				
226. „ (Tretomphalus) bulloides (*d'Orb.*)	v. r.					
227. Discorbina ventricosa, *Brady*	v. r.					
228. „ parisiensis (*d'Orb.*)	...	...	...	...	v. r.	
229. „ rosacea (*d'Orb.*)	...	...	...	...	v. r.	v. r.
230. „ rugosa (*d'Orb.*)	...	...	...	...	...	r.
231. Planorbulina acervalis, *Brady*	v. r.	v. r.				
232. „ larvata, *P. & J.*	...	...	...	...	...	v. r.
233. Truncatulina lobatula (*W. & J.*)	r.	...	...	...	v. r.	r.
234. „ wuellerstorfi (*Schwager*)	v. c.	...	c.	c.	r.	r.
235. „ pygmæa, *Hantken*	r.	...	...	...	r.	
236. „ ungeriana (*d'Orb.*)	f.	r.	r.	c.	r.	f.
237. „ haidingerii (*d'Orb.*)	r.	...	...	...	r.	v. r.
238. „ robertsoniana, *Brady*	r.	...	...	...	...	v. r.
239. „ dutemplei (*d'Orb.*)	r.					
240. „ præcincta (*Karrer*)	...	r.				
241. Truncatulina akneriana (*d'Orb.*)	...	...	v. r.			
242. „ tenera, *Brady*	...	...	...	r.	v. r.	v. r.
243. „ culter (*P. & J.*)	...	...	...	...	...	v. r.
244. Anomalina grosserugosa (*Gümbel*)	r.	...	...	...	...	f.

Species and Varieties.	Samples.					
	1.	2.	3.	4.	5.	6.
245. Anomalina polymorpha, *Costa*	...	v. r.				
246. Pulvinulina repanda (*F. & M.*), var. concamerata (*Mont.*)	v. r.					
247. ,, elegans (*d'Orb.*)	c.	...	f.	v. c.	v. c.	c.
248. ,, partschiana (*d'Orb.*)	r.	...	...	r.	r.	r.
249. ,, menardii (*d'Orb.*)	v. c.	c.	...	c.	f.	c.
250. ,, ,, var. fimbriata, *Brady*	v. r.	...	...	r.		
251. ,, canariensis (*d'Orb.*)	r.	...	...	...	v. r.	r.
252. ,, tumida, *Brady*	f.	...	...	r.	...	f.
253. ,, micheliniana (*d'Orb.*)	r.	...	c.	...	...	v. r.
254. ,, pauperata, *P. & J.*	r.	...	r.	f.	...	r.
255. ,, auricula (*F. & M.*)	r.	v. r.				
256. ,, oblonga (*Will.*)	r.					
257. ,, punctulata (*d'Orb.*)	v. r.					
258. ,, exigua, *Brady*	...	v. r.	...	...	v. r.	v. r.
259. ,, karsteni (*Reuss*)	...	...	...	...	...	r.
260. Rotalia orbicularis, *d'Orb.*	v. r.	...	...	...	r.	v. r.
261. ,, calcar (*d'Orb.*)	c.					
262. ,, soldanii, *d'Orb.*	c.	...	r.	r.	r.	f.
263. ,, broeckhiana, *Karrer*	...	...	v. r.	...	v. r.	c.
264. Calcarina hispida, *Brady*	...	r.				
265. ,, nicobarensis, *Schwager*	v. c.	r.				
266. ,, defrancei, *d'Orb.*	v. r.					
Subfamily TINOPORINÆ.						
267. Gypsina globulus (*Reuss*)	...	v. r.				
268. Polytrema miniaceum (*L.*)	r.					
Family NUMMULINIDÆ.						
Subfamily POLYSTOMELLINÆ.						
269. Nonionina umbilicatula (*Mont.*)	r.	...	...	...	f.	r.
270. ,, pompilioides (*F. & M.*)	v. r.	...	...	...	v. r.	r.
271. Polystomella crispa (*L.*)	r.	v. r.				
Subfamily NUMMULITINÆ.						
272. Amphistegina lessonii, *d'Orb.*	f.	c.	...	r.		
273. ,, radiata (*F. & M.*)	...	c.				
274. Operculina complanata, (*Defr.*)	f.					
275. ,, ,, var. granulosa, *Leym.*	...	r.				
276. Heterostegina depressa, *d'Orb.*	v. r.	f.				
Subfamily CYCLOCLYPEINÆ.						
277. Cycloclypeus guembelianus, *Brady*	v. r.					

EXPLANATION OF PLATE I.

Fig. 1. *Biloculina tubulosa*, Costa (p. 7); lateral aspect. × 16.

2. *Haplophragmium truncatuliniforme*, sp. nov. (p. 16): *a*, superior aspect; *b*, inferior aspect; *c*, peripheral aspect. × 30.

3. *Bolivina arenosa*, sp. nov. (p. 24): *a*, lateral aspect; *b*, oral aspect. × 20.

4. *Lagena aspera*, Reuss, var. *spinifera*, nov. (p. 27). × 20.

Fig. 5. *Lagena marginata* (Walker and Jacob), var. *catenulosa*, nov. (p. 28): *a*, lateral aspect (at *pp* are shown parasitic-alga-borings in the shell-flange); *b*, oral aspect. × 17.

6. *Nodosaria* (*Dentalina*) *soluta*, Reuss, var. *subaculeata*, nov. (p. 3). × 10.
7. *Biloculina tubulosa*, Costa (p. 7). An abnormal specimen with two apertures. × 16.
8. *Amphistegina radiata* (Fichtel and Moll) (p. 45): *a*, lateral aspect; *b*, peripheral aspect. × 10.
9. *A. radiata* (F. & M.) (p. 45). A transverse section showing the asymmetrical habit of growth in the successive layers of whorls, the non-tubulate umbonal centres, and the somewhat irregular overlapping of the whorl-layers on both sides of the shorter axis. × 14.
10. *A. radiata* (F. & M.) (p. 45). Small portion of a median horizontal section of the test, showing at *a a* two septa traversed by the canal-system; below this at *b* is the marginal cord of the preceding whorl with its canal-system. × 135.
11. *A. hauerina*, d'Orbigny (p. 46). Part of a septum, showing interseptal canals at *a*. This is taken from a typical fossil specimen of *Amphistegina* from the Vienna Basin, for comparison with the recent form, *A. radiata* (F. & M.). × 520.
12. *A. radiata* (F. & M.) (p. 45). One of the chambers of the peripheral whorl in a median horizontal section, enclosing a young individual consisting of two chambers. × 135.

2. An Enumeration of the Hemiptera-Homoptera of the Island of St. Vincent, W.I. By P. R. Uhler. (Communicated by Dr. D. Sharp, F.R.S., F.Z.S., on behalf of the Committee for investigating the Flora and Fauna of the West-Indian Islands[1].)

[Received November 16, 1894.]

The Homoptera of St. Vincent, collected by Herbert H. Smith, constitute an assemblage of forms mostly small and neat, which offer a striking contrast to the large and showy insects that inhabit the regions of the South-American continent a few hundreds of miles away. It is not, however, to this nearest part of the continent that we must look for the source of distribution from whence this assemblage was derived. The Mexican character of the fauna seems unquestionable.

Fam. CICADIDÆ.

Genus Proarna, Stål.

Proarna hilaris, Germ. Silb. Rev. Ent. ii. p. 69, 34.

Numerous specimens were collected at various localities in the island. The individuals are of different sizes, the males being much smaller than the females. The fully-coloured and well-matured specimens are greenish, with the silvery pubescence and white bloom coating the surface thickly. Immature and freshly-excluded specimens have the costal margin and veins of the wing-covers rufous or yellowish and most of the body testaceous. The broad black stripe current from the head to base of pronotum is absent, or nearly so, in the pale varieties, as are also black bands from the femora and tibiæ. There is scarcely a substantial character now remaining to separate this species from *P. albida*, Oliv.; and now, as our collections are growing large, the species of this genus are becoming more comprehensive and less distinctly separable.

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[1] [The Hemiptera-Heteroptera of St. Vincent have been described by Prof. Uhler in the P. Z. S. 1893, pp. 705–719, and 1894, pp. 156–160. The species of Membracidæ, described by Dr. Goding, and mentioned *postea* p. 57, form also part of the collections transmitted by the Committee to N. America for examination.—D. S.]

This small form inhabits also Jamaica, Cuba, San Domingo, and St. Thomas. The next size larger is found in Mexico and Central America.

PROARNA SQUAMIGERA, sp. nov.

Luteous or pale green, more or less clothed with scale-like, prostrate, silky pubescence, which readily rubs off. Head short, blunt, the vertex deeply grooved on the middle line, closely hairy, marked with a black band on the area of the ocelli, and sometimes with a black tubercle each side; the front almost flat on top and hairy, smooth, and yellow in the middle of this part, from each side of which a curved black stripe converges towards the middle and continues down to near the clypeus; the transverse grooves almost straight, but not quite symmetrical; cheek between the eye and front dark brown and coarsely wrinkled; clypeus smooth, pale, usually marked with a brown spot; the rostrum pale, tipped with piceous, reaching between the posterior femora; first and second joints of antennæ piceous black, excepting the ends, the following joints growing paler towards the tip. Pronotum narrowing anteriorly, curving well over the base of the head, having the sutures mostly black, and with an oblique black streak each side of the middle of the dorsal wedge, and sometimes with a double streak each side behind it; the lateral margin widely reflexed, and carried as a wide lobe much below the line of the eyes, the humeral angle broadly lobate and turned up; mesonotum smooth, very moderately convex, usually marked at base with four obconical black stripes, of which the two inner ones are most distinct and shorter; the space in front of the mesonotal cross wide, deep, and often infuscated, the cross quite prominent, short, and less deeply sinuated behind. Legs greenish, yellow when faded, usually with a black spot near the base and tip of the femora, and with the knees and end of tibiæ, more or less of the tarsi, and the tip of the nails blackish piceous. Wing-covers vitreous, tinged with green in the matured insect; the veins greenish, interrupted with dark brown on the apical series, the anastomosis at tip of costa marked with a black fork; base of the first forked vein back of this has a dark spot, and the next vein inward from this has also a dark spot; veins of the base of the costal areoles each with a dark cloud, excepting the middle and inner ones; transverse border vein of the apex of the apical areoles, excepting the two outer ones, marked on the middle with a brown spot; the first apical areole long and wide, a little shorter than the third, and more than twice as long as the second, the second expanded at tip; the basal areole long, black at tip, and with the costal areole bordered above and below with black; apex of the clavus blackish. Breast invested all over with white flocculent matter accompanying the pubescence; the opercula are broad, in contact on the middle line, a little angularly curved behind, and the extero-posterior margin reflexed and almost sinuated. Venter smooth, powdered with white, the basal segment of male composed of two thick ribs, which are sinuous each side and triangularly prolonged at base to fit into the emargination between the opercula. Tergum pubescent, sometimes spotted with fuscous on the sides, and banded with dark brown on the borders of the incisures; the basal segment of male often broadly white each side.

Length to tip of venter, ♂ 22–23, ♀ 26–28 mm.; to tip of closed hemielytra 34–43 mm.; width of base of pronotum 9–11 mm.

This species was taken at two or three localities on the island. Several specimens were secured which show marked differences in the ground-colour and extent of dark marking. Much of this is, however, due to degree of maturity and condition of the specimen at the time of capture. These, together with *P. chariclo*, Walker, and the allied green species with more dilated pronotum from Cuba, San Domingo, and Colombia, form a chain of connection between *Odopœa* and *Tympanoterpes*, Stål. The obliquity or curvature of the cross-vein of the second apical areole is too gradative to furnish a substantial separative generic character.

This species, although closely related to *P. chariclo*, Walk., should not be confounded therewith. Besides the expansion of the pronotum and its different marking in *P. chariclo*, it has the dots of the apical series of areoles next the ends of the longitudinal veins, and not on the cross-veins as in our species. In this new species the basal areole is broader, the opercula close in contact, and the basal segment of venter not single.

Fam. MEMBRACIDÆ.

The specimens of this family have not been sent to me for examination, and accordingly I can only judge of the value of the species described by Dr. Goding from a study of specimens secured in Grenada, Trinidad, and the Greater Antilles.

The following list includes all the species reported by Dr. Goding from the island:—

ENCHOPHYLLUM RILEYI, Godg. Canad. Ent. xxvi. 1893, p. 56.

Five individuals are recorded as having been collected in St. Vincent.

ACUTALIS TRIFURCATA, Godg. Canad. Ent. xxvi. p. 53.

Cited as from St. Vincent. Coll. H. H. Smith.

ACUTALIS APICALIS, Godg. Canad. Ent. xxvi. p. 53.

Reported as from the same island by the writer quoted above.

SPONGOPHORUS ALBOFASCIATUS, Godg. Canad. Ent. xxv. p. 54.

Also cited as from St. Vincent.

SPONGOPHORUS VEXILLIFERUS, Godg. Canad. Ent. xxv. p. 53.

Likewise cited as from St. Vincent.

BOLBONOTA BISPINIFERA, Godg. Canad. Ent. xxv. p. 55.

Reported as belonging to the collection made in St. Vincent by Mr. H. H. Smith.

MONOBELUS FASCIATUS, Fabr. Ent. Syst., Suppl. p. 515. no. 33.

This is a very variable species which is widely distributed in the Antilles. I have examined specimens from Cuba, Jamaica, San Domingo, St. Vincent, and Grenada.

Fam. CERCOPIDÆ

TOMASPIS PICTIPENNIS, Stål, Stettin. ent. Zeit. xxv. p. 63

The more typical form of this species is common in Mexico in the vicinity of Orizaba.

Only one specimen is in the collection from St. Vincent, but several others are in that from the island of Grenada. It is more variable and abnormally coloured in these Lesser Antilles than we have seen it to be in Mexican specimens.

Fam. FULGORIDÆ.

DICTYOPHARA EMARGINATA, sp. nov.

Pale green, long oval, with the cephalic prolongation a little curved upwards, scarcely twice as long as the pronotum, a little curved on the sides, hardly wider at base than on the middle, with the upper surface flat, carinated on the outer margins and on the middle line, with the base of the middle carina forming a Λ, the tip subconical with curving sides; base of head triangularly emarginated; front with thick carinate margins and a prominent carina along its entire length; eyes a little angular, nearly bean-shaped, brownish when dried; rostrum reaching to the posterior coxæ. Pronotum short, triangularly produced into base of head, the base emarginated almost as acutely as the head, with the middle line interruptedly carinate. Mesonotum feebly convex, very strongly tricarinate. The posterior tibiæ with three spines exteriorly. Hemelytra almost opaque, with the costal margin broadly curved; the veins few and straight, with five long areoles including the wide costal one, and no transverse veins in the ulnar series; twelve long narrow areoles in the apical series, most of which have three or four transverse veins towards the middle; the apex more transparent than the corium.

Length of body 5 mm.; width of pronotum 1½ mm.; length to tip of wing-cover 7–7½ mm.

This species approaches nearest *D. cultellator*, Tweedie, but the head of the former is much shorter and wider, and the venation simple, not dense.

TANGIA ANGUSTATA, sp. nov.

Pale green, narrower than usual, the wing-covers slightly curving towards the base, with the costa almost straight from thence to the membrane. Head a little longer than wide, with the tip rounded, but hardly narrowed, the margins prominently reflexed, the middle line carinated, with its basal half triangularly divaricating; front long, the sides feebly sinuated and expanding somewhat triangularly before the tip, the middle line with a thick carina throughout; epistoma also carinate; rostrum reaching to the middle coxæ. Pronotum about half as long as the head, almost of the form of a horse-shoe, the ends tapering posteriorly, the middle line acutely carinate. Mesonotum long, distinctly carinate on the middle line, the apex subovate, and the base triangularly narrowed with the end truncate. Hemelytra with simple straight veins, the inner discoidal vein only forking beyond the middle; no transverse veins on the corium, the longitudinal veins all forked at tip to form the boundary of the membrane, the membrane tapering a little on the inner apical border; the veins and cross-veins numerous and rather close-set, more or less dusky in the matured individuals. Posterior femora with three spines besides the pair on the tip.

Length to end of venter 5½ mm.; width of pronotum 1½ mm.; length to tip of wing-covers 7 mm.

Two specimens were taken in St. Vincent, one of them on the windward side. They are precisely like others which were secured on the island of Grenada.

TANGIDIA, gen. nov.

Similar to *Tangia*, but with a broad shield-like head and less symmetrical venation to the corium. Head with the eyes as broad as the front of pronotum, the vertex a little longer than wide, subsemicircular in front, with the lateral margins stoutly reflexed; the central carina Λ-shaped, with the tip touching the apex and set in a sunken surface; front broad oval, nearly twice as long as its width, with reflexed margins and a carinate middle line. Pronotum somewhat horseshoe-shaped, almost triangular in front, and carried deep into the notch in the head, Λ-carinate in the middle, the lateral prolongations tapering narrow posteriorly; mesonotum much longer than wide, with carinate sides and middle line, the posterior angles obliquely truncated. Hemelytra nearly three times as long as the width, translucent, the posterior margin straight; discoidal veins long, the middle one simple, the inner one forked behind the middle, the outer one twice forked next the membrane, the veins continuing this line across are oblique, and then straight in regular succession to the posterior margin; cells of membrane mostly quadrangular, longer than wide. Posterior tibiæ with three spines behind the tip.

TANGIDIA ALTERNATA, sp. nov.

Pale fulvous, polished, broad, moderately flat. Head lined around the margins with white, and the triangle and oval reliefs of the sides of vertex also white; front pale yellow, the upper submargin black; eyes placed horizontally, long, oval, brown; rostrum extending to the middle coxæ. Raised margins and carinate line of both pro- and mesonotum whitish. Costal areole long, wide, terminating in an acute pterostigma of dark brown colour; veins pale testaceous, interrupted by dark brown, the brown of the membrane most conspicuous on the apical margin and cross-veins; wings a little tinged with fulvous at base, the veins darker at tip. Sides of thorax streaked with pale brown, and a darker line runs back from behind the eye. Legs pale yellow; knees a little infuscated, the tips of spines black, and a short dark streak appears beneath the posterior knee. Venter greenish, broadly bordered with red, segments of the tergum obscurely banded with rufous and bordered with pale yellow.

Length to tip of abdomen 4 mm.; width between wing-covers $1\frac{3}{4}$ mm.; width of expanded wings 10 mm.

Only one specimen of this neat insect was secured.

BOTHRIOCERA SIGNORETI, Stål.

Seven or eight specimens of the variety of this species, with the pale spot occupying most of the basal third of the corium, were collected at various localities on the island.

BOTHRIOCERA BICORNIS, Fabr.

Seven specimens of this form were collected at different points on the island. They differ in minor details of marking from Brazilian and North-American specimens. This species is found also in Texas, Florida, North Carolina, Maryland, and New Jersey. In the last two States it is found in midsummer upon grass-like plants in the cranberry marshes.

BOTHRIOCERA UNDATA, Fabr.

Ten specimens of several states of immature colouring are present in the collection from St. Vincent. I find no structural differences to separate these from the foregoing species; and several specimens are so immature as not to have developed a pattern of marking.

CATONIA, gen. nov.

Form of *Plectoderes*, and apparently related to that genus in general structure. Long subovate, with the hemelytra opaque throughout, almost straight, but feebly curved at base and apex, with the veins coarse and prominent. Vertex about half as wide as the pronotum, tapering a little towards the tip, a little longer than the large subglobular eyes, scooped out lengthwise and carinated, the tip more or less acutely curved and with the margin reflexed, arched above, base triangularly excavated, and carinate on the border; front long, carinated, widening towards the epistoma, and with curving reflexed sides, the reflexed border continued on the epistoma. Rostrum reaching to the posterior coxæ. Pronotum constituting a very narrow collar, triangularly excavated behind and prolonged into the triangular aperture of the head, the pleural part expanded into a wide rounded flap below the eyes. Mesonotum a little wider than long, sinuated each side in front, tricarinate, triangularly narrowing posteriorly, with the scutellum depressed and nearly equilateral triangular. Posterior tibiæ unarmed, excepting at tip, where the middle spine is much longer than the others. Veins of disk of corium simple and nearly straight, the radial vein forked behind the middle of the corium and the second ulnar also forked at nearly the same distance, the apical series of areoles forming a nearly symmetrical curve around the arc of the apex of membrane, but arrested in the inner angle by a long and wide, nearly straight areole; costal space most opaque, long, acute at tip, and bounded there by a small triangular cell. Antennæ composed of a large globular base, with a very fine bristle projecting from it.

CATONIA INTRICATA, sp. nov.

Fuscous, somewhat shaded with paler colour. Face a little paler than the body, minutely and closely speckled with fuscous, the carinated margin interrupted with fuscous; front a little longer than wide, slightly tapering at apex, prominently carinated on the lateral margins, and there more distinctly marked with pale dots; cheeks and pleural pieces marbled and speckled with fuscous and testaceous. Pronotum testaceous, dotted with fuscous. Legs smoke-brown, the anterior and middle tibiæ with a yellow band on the middle, besides others at base and tip, and on posterior tarsi. Mesonotum minutely dotted with testaceous. Hemelytra covered with minute pale granules, the costal area varied with testaceous, and sometimes tinged with rufous at tip, longitudinal veins interruptedly testaceous; the membrane paler, margined with fuscous, also with two arcuated brown clouds, the longitudinal veins brown and white at intervals, white at tip, the transverse veins white. Venter dull fuscous, with patches of white on the middle and sides.

Length to tip of abdomen 4 mm.; to end of hemelytra $5\frac{1}{2}$ mm.

One specimen was secured in the Petite Bordelle Valley, at an altitude of 1600 feet above the sea. It was taken from foliage in a damp forest, October 6th. Other specimens were found at various points on the island, which are not recorded in any list accessible to me.

The generic name given above is derived from that of the great tract of land belonging to the Caton family in Maryland, where *Flata* (*Catonia*) *nava*, Say, occurs, and where another species, *Cixius* (*Catonia*) *cinctifrons*, Fitch, abounds in autumn upon the white hickory and oak trees.

CUBANA, gen. nov.

Abdomen more prismatic above and less flat than in *Catonia*, with the hemelytra opaque, and the membrane not bent inwards as in that genus. Head a little longer than the eyes, with the lateral keels highly arched above the surface of the vertex and front; the vertex deeply sunken, almost regularly quadrangular, with the middle keel more distinct in one species than in the other; front long and moderately wide, the side strongly carinate and curving, becoming widest at the clypeus, and the curve continued tapering to the tip, the middle carina exceptionally high, as much elevated as the lateral margins, complete to tip of clypeus. Pronotum unusually short, expanding into saddle-flaps each side inferiorly. Mesonotum with a tabular disk, which is much longer than wide, tricarinate, the outer carinæ spreading apart posteriorly, and behind this point the scutellum extends back in a triangle. Wing-covers growing very gradually wider towards the tip, bluntly rounded at tip; four long discoidal areoles running out to the oblique cross-veins, which form the base of the apical areoles; the costal area crossed by three oblique veins before reaching the nodal mark, this latter followed by about four curved veins before the apex is reached; areoles of apical series long, the fork connected with the middle vein longer than the others; basal areole small and narrow; wings with three forked veins and two transverse veins towards the tip. Posterior tibiæ destitute of spines before the tip.

The generic name here given is derived from Cuba, on which island these insects were first taken.

CUBANA TORTRIX, sp. nov.

Pale dull brown, moderately robust, with all the carinate lines and borders and tip of scutellum pale testaceous. Grooves of face blackish. Underside of body mostly pale testaceous. Legs testaceous, with the spurs of tibiæ and tips of tarsi piceous. Wing-covers shaded with pale brown, the veins mostly ivory-yellow; the cross-veins of costal area, an oval spot beyond the tip of the costa, almost encircled by a slender arc before and behind, the slender apical margin, a bent line crossing the membrane diagonally near its middle, a paler bent line across the middle of the corium, and a short stripe at the apex connected with the margin posteriorly, brown, sometimes also a pale brown streak at base of corium and two or three traces on the postero-apical portion of the corium and membrane; wings smoky, with pale brown veins.

Length to tip of abdomen $3\frac{1}{4}$–$3\frac{1}{2}$ mm.; width between wing-covers $1\frac{1}{4}$ mm.; expanse of wing-covers 10–$10\frac{1}{2}$ mm.

This beautiful little insect was found at Kingstown and at other places on the island, and at altitudes from 1500 to 2500 feet above sea-level.

A closely related species was sent to me many years ago from the island of Cuba by Dr. John Gundlach.

Cubana irrorata, sp. nov.

Pale fulvous, more or less farinose posteriorly, both above and below. Head a little less oblique at the summit of the front than in the preceding species. Carinate lines of the head and thorax a little paler than the adjoining surface. The under surface paler than the upper. The mesonotum dark brown and the scutellum pale. Inferior margin of the thorax pale. Legs pale testaceous, with the tip of the tarsi piceous. Wing-covers mostly whitish, faintly tinged with brown towards the tip, the veins interrupted with brown, near the apex more distinctly streaked with black, and with a blackish dot near the inferior apical extremity; clavus with three dark oblique bands, the outer one of which is much wider than the others; near the base of corium are several faint streaks, followed on the middle by a bent band which touches a stripe on the lower border; the base of membrane is bounded by a wavy band which covers the white cross-veins; beyond this the membrane has several angular streaks near the upper margin, a diagonal band running back from the middle, and a curved stripe behind the dot next the lower border. Wings a little smoke-tinged, the veins brown.

Length to tip of abdomen $2\frac{3}{4}$ mm.; expanse of wing-covers 10 mm.

Four specimens, all in less mature condition, were collected by Mr. Smith.

Cotyleceps, gen. nov.

Form of *Bothriocera*, excepting in the shape of head. Vertex shorter than the eyes, but projecting nearly the full length in front of them, with the surface deeply sunken and the sides correspondingly and acutely elevated, having the line of contact with the front indented; the front long, deeply scooped out, with the sides foliaceous, expanded and then tapering to the tip of the epistoma, the carina of the middle much lower than the sides, point of junction between front and epistoma indented and occupied by an ocellus, epistoma with a low and thick carina; cheeks broad, somewhat foliaceous, excavated above the eyes; rostrum reaching to the posterior coxæ. Pronotum very short, saddle-shaped, deep-seated, and upturned in the middle, regularly wide on the sides extending downwards. Mesonotum with the dorsal shield long and narrow, carinate in the middle, with the lateral carinate margins spreading apart posteriorly, with the scutellum large, triangular, depressed in the middle. Posterior tibiæ with a stout spur below the middle, and the principal one at tip thick and long. Wing-covers gradually and almost symmetrically widening towards the tip, the tip almost bluntly rounded, with the inner arc a little narrower than the outer one; veins of the middle of apex straight, bounding long and narrow areoles, one on either side of the four middle ones forked, those of the upper extremity curved outwards; middle longitudinal nerve with two curved forks near its tip. Wings with the veins divided into two short forks at the upper extremity and a longer fork next inward of the former, and with two cross-veins forming a chevron beyond the middle. The abdomen is somewhat prismatic, with the central ridge prominent; the venter moderately wide and not quite flat.

COTYLECEPS DECORATA, sp. nov.

Dull fulvous brown, paler beneath. The cheeks, sides, and summit of the front and middle of the vertex dark piceous. Eyes dark brown. Antennæ pale fulvo-testaceous, the basal joint longer than wide. Pronotum and sides and shield of mesonotum fulvous, darker on the sutures and across the base; the scutellum paler. Rostrum and legs pale testaceous. Wing-covers whitish testaceous, extensively marked with pale smoke-brown; border of the membrane broadly smoke-brown, connected on the lower border with a large interrupted spot which connects on its inner end with broken spots continued across the disk, the apical veins being white break the continuity of the apical border; field of both corium and membrane sparsely flecked, the three transverse veins of the costal area broadly marked, the inner one connected with a ragged band which nearly crosses the corium; nodal spot long and darker than the uneven series which forms a sort of loop behind it; the membrane beyond this point has three united spots anteriorly and a roundish one adjoining the posterior end of the loop next the margin; wings smoky, with the veins darker. Tergum paler at tip and along the lateral submargin.

Length to tip of abdomen 4 mm.; expanse of wing-covers 13 mm.

This delicate little insect bears some resemblance to some of the more strongly marked Phryganidæ of the genus *Hydropsyche*. A few specimens were secured at Kingstown and at other points up to an altitude of 500 feet above the sea.

AMBLYCRATUS, gen. nov.

Form robust, with depressed abdomen, which is fully one-half wider than the breadth across vertex and eyes. Head broad, almost truncated as viewed from above, the front of the vertex is, however, a little angular at tip and obliquely carinated each side, with the middle partly carinated, depressed; front curved outwards before the tip of vertex, long and wide, a very little wider than, and curved at the origin of, the epistoma, with the middle line strongly carinated and the lateral margins sharply reflexed, the epistoma tapering and continuing the gentle curve of the sides with the carina and reflexed margin; cheeks wide, long, excavated, with the reflexed borders rising prominently above the eyes. Basal joint of antennæ subglobose as usual. Pronotum very short, the front edge upturned, with the sides curved, but little wider, and ending below in a slight enlargement. Mesonotum a little wider than the length including the scutellum, the sides expanded triangularly, but the medial shield narrow, almost square, carinated on the middle, and bounded by a carina on each side, the scutellum acutely triangular, a little reflexed like the wings of the preceding segment. Wing-covers narrow, a little bent at tip, with the inner apical corner angular, shorter than the upper which is curved; costal area long and narrow, expanded at tip in contact with the ovate nodal cell, its middle a little acute where the anastomosis of the first fork occurs, the first ulnar areole starting from a fork beyond the middle of the costal area and extending in a slight curve to the nodus, the second one starts in a fork near the base, and continuing sends off a vein from a blunt fork on a line with the nodus, at this point three oblique cross-veins form the base of the middle anteapical areoles; the apical areoles longer, narrow, seven in number, of which the anterior one is very short and triangular, while the posterior one is very long and wide and ending in an acute, somewhat curved angle. Posterior tibiæ destitute of any apparent spine.

AMBLYCRATUS PALLIDUS, sp. nov.

The body relatively broader, but the wing-covers narrower, and not obliquely expanding towards the tip as in the foregoing genera. Colour pale fulvous, tinged with pale testaceous. Head almost square, as seen from above, with the blunt triangle of the tip of vertex on a line with the front of eyes, powdered with white; the eyes brown, somewhat bean-shaped; antennæ pale fulvous; summit of front and a faint band across its middle dusky; epistoma also a little dusky. Rostrum reaching to behind the posterior coxæ. Wing-covers whitish yellow, or very pale fulvous, with the costal vein mostly brown, the nodal spot whitish, and the apical anterior margin of the membrane pink; veins of the ulnar areole, an oblique streak at base, the posterior border and two lines on the clavus, the posterior edge of the membrane and the coarse vein next inwards, and a broad uneven spot across the apical half of the membrane smoke brownish; the transverse veins of membrane whitish. Underside and legs testaceous, with a tinge of plumbeous; tip of the venter dark brown. Disk of mesonotum and surface of tergum dark brown.

Length to end of abdomen 3¼ mm.; expanse of wing-covers 9 mm.

Six specimens of this peculiar insect were taken at Kingstown and various other localities on the island,

CIONODERUS, gen. nov.

Long and narrow, with the wing-covers carried flat as in *Plectoderes* and *Catonia*. Vertex short and nearly square, a little wider than long, with the apex bluntly angular, the margins recurved all around, and the depressed middle carinated, the posterior margin widely sinuated; eyes large, prominent, placed obliquely; front wide, prominently curved above, separated from the vertex by an impressed line; middle carinated, sides a little expanded in the curve next the epistoma, the epistoma narrowing to the apex; cheeks wide beneath the eyes, the curve carried above the eyes short. Pronotum with the anterior lobe excavated, protracted into the base of the head like a semicircular valve, with a small tubercle at base, the sides carried down in narrow belts. Mesonotum convex, a little longer than wide, with the tubular middle narrowly oval, margined by carinate lines, and with a carina on the middle; the scutellum triangular depressed in the middle, acuminate. Wing-covers long, bent inwards at tip, opaque, the clavus long, acutely narrowing towards the tip, with the fold near the inner border narrow and nearly parallel with the border; costal area long, widening towards the base of the first forked vein, and narrowed from thence by the curve of that vein; discoidal members of the anteapical series of areoles very long, those near the costal border strongly curved, the apical series shorter and mostly curved. Ocellus placed, as in the preceding genus, at the anterior angle of the eye and beneath it.

CIONODERUS LINEATUS, sp. nov.

Chiefly brown above, yellowish testaceous beneath. Head pale, a little clouded across the middle of the front and upon the epistoma; the lateral carinate edges, the front border and carina of the vertex brown. Pronotum marked with brown at intervals. Mesonotum brown, with two middle stripes, the sides, and the borders of the scutellum pale yellowish. Legs mostly pale yellowish, with the tip of tibiæ and outer surface of tarsi a little dusky. Wing-covers darker brown on the basal two-thirds, including the clavus, but with the veins mostly yellowish; the costal area, including the nodus and the space at fork of radial vein, besides the apex of the clavus and the transverse veins of the membrane, also yellowish. Tergum dark brown.

Length to tip of wing-covers 5¾ mm.; width across middle of mesonotum 1½ mm.

Two fairly complete, and one mutilated, specimens were secured on the island.

VINCENTIA, gen. nov.

Form of *Cixius*, Latr., and with clear wing-covers and wings. Head but a very little longer than the eyes; the vertex very narrow, with the carinate borders only a little higher than the eyes, bounding a deeply sunken surface, and converging to an angle in front; the front rapidly expanding in a curve to the middle, with the sides tapering to an acute point at apex of epistoma, the summit of the middle carina a little expanded, the lateral margins foliate-carinate. Pronotum very narrow in the middle, deeply triangularly emarginate like the base of the head and entering so deeply as to be almost concealed by the occiput and eyes; the marginal edge fitting against the eyes carinated. Dorsal shield of mesonotum about twice as long as wide, with straight carinate sides and triangular ends, the middle incompletely carinate and with a short ridge each side; the scutellum short, acute, set upon a broader semicircular flap which is protracted each side anteriorly out to the base of the wings. Wing-covers broad, of nearly equal width throughout, transparent, with the veins granulated as in *Cixius*; the costal areole long and wide, of nearly equal width throughout, followed by a narrow and very acute nodal areole, six anteapical areoles, of which the upper and lower are longer than the others and are bounded by a fork of the veins on the middle of the corium; the membrane terminating in a nearly regular curve, the apical series of areoles almost symmetrical, the four following the nodus placed obliquely. Wings with the areole next to the first apical one large, bounded at base by a transverse vein, separated at tip by a short triangular areole, the four following areoles triangular at base. Posterior tibiæ with two stout spurs before the middle and another at tip, besides the crown of small teeth. Abdomen broad, depressed, carinately elevated on the tergum.

VINCENTIA INTERRUPTA, sp. nov.

Chestnut-brown, paler beneath, fulvous anteriorly. Front tinged with dull fulvous; the carinate lines, sides, upper part of cheeks, and the rostrum pale yellowish. Eyes brownish black, large, suborbicular, bordered with pale yellow, deeply emarginated below. Pronotum mostly pale yellow, darker on the sides, but with all the margins yellowish. Mesonotum fulvous on the disk, bordered with yellowish; the discal carinate lines partly yellowish. Mesosternum, including the flat coxæ, with a broad brown band which corresponds with the brown area of the epistoma; pleural line marked by series of angular, scale-like, pale spots. Scutellum pale at tip and on the sides. Legs clouded with smoke-brown, pale on the knees, at the ends of the tibiæ, and on the ends of the tarsal joints. Wing-covers with two coalescing brown spots at base, two similar ones on the middle, also a diagonal nodal spot; the transverse veins, ends of the apical veins, costa, and two or three streaks on the posterior marginal vein brown, remainder of this vein, base of nodal spot, and veins around it pale yellowish.

Veins of the wings mostly brown. Borders of segments of the abdomen slenderly white, both above and below, exterior edge of the connexivum also whitish. Tip of the venter densely loaded with white flocculent matter.

Length to end of abdomen 5 mm.; expanse of wing-covers 12½ mm.

Only a single specimen of this neat-looking species was secured on this occasion.

This genus resembles *Mnemosyne*, Stål, in the shape of the vertex, but differs in the type of pronotum as well as in the venation of the wing-covers.

CHEILOCEPS, gen. nov.

General form of *Issus*, with the wing-covers longer than wide, a little tapering towards the tip, and the tip obliquely truncated. Head narrower than the pronotum, the vertex subquadrangular, a little longer than wide, scooped out, the prominent keeled margins projecting a little beyond and above the eyes, the middle line with a slight keel; the base of head triangularly emarginated. Eyes very large, longer than wide. Front of medium width, growing wider next the clypeus, with each side raised into a liguliform relief which ends below in a button, middle of the front depressed, oval, carinate on the middle line; clypeus placed diagonally, convex on the middle, carinated, with the lateral margins curved near the base, acutely tapering towards the tip; the base prominent, and a little excavated on the margin. Pronotum a little shorter than the head, but wider than the diameter across the eyes, triangular, let into the base of the head, slender behind the eyes, but expanding beneath them. Mesonotal shield obtriangular, wider than long, with a transverse carina at base, from which a short carina runs back on either side; the scutellum small, acute. Wing-covers moderately narrow, the costal membrane at base wide but not abruptly expanded, longitudinal veins carried through to the tip and curving forward there; transverse veins few, mostly placed on the apical third, the radial vein forked and curved at tip; the costal areole crossed by numerous veins beyond the middle. Wings long and wide, cleft, with few and mostly large areoles, the accessory membrane a little longer than the abdomen without the *genitalia*. Posterior tibiæ armed with two spines. Abdomen broad, a little depressed, interruptedly carinate on the middle of tergum.

CHEILOCEPS MUSCA, sp. nov.

Fulvous, paler on the wing-covers. Middle of the vertex and ground-colour of the front and clypeus pale smoke-brown; lateral margins of the vertex tinged with rufous, the other margins and carina pale testaceous; the raised sides of the front yellowish irregularly spotted with dark brown, and the underside of the buttons especially brown; a whitish band crosses the upper portion of the front, and the middle carinate line is interruptedly brown and yellow; the base of clypeus, including the carina, margins, and oblique striæ, also yellowish. Rostrum extending to the posterior coxæ, pale testaceous banded with brown. Eyes dark brown, with the reflexed socket pale yellow. Antennæ pale fulvous, placed on the rim of the socket next below the eyes. Pronotum pale fulvo-testaceous, tinged with rufous in front and on the sides; the disk granulated each side on a large brown spot, the propleura with a brown dot near the origin of the wing-cover. Mesonotum darker on the shield, and this part is divided into areas by two yellowish loops on the sides and a line along the middle; the scutellar portion pale yellowish. Pleural segments pale yellow above, mostly margined with black. The coxæ bright red, excepting the base of the posterior pair; legs dull yellowish, the anterior femora faintly striped with brown, and the tarsi brown at tip. Wing-covers translucent, with five brown dots, and a few obscure cloudy spots at base, near the posterior border, and next the tip. Tergum a little dusky near base and at tip. Veins of wings black.

Length to tip of venter 6 mm.; expanse of wing-covers 15 mm.

Only two specimens of this remarkable insect were secured.

PERSIS LINEATA, Fabr.

Specimens of this delicate little species were collected on both sides of the island by Mr. H. H. Smith.

PATARA GUTTATA, Westw.

Three specimens were secured on this island.

PATARA ALBIDA, Westw.

Only a single specimen was taken. It was found on the windward side of the island.

CENCHREA DORSALIS, Westw.

Four specimens of this insect were collected. Three were secured near Kingston at an altitude of 1500 feet, and the fourth was found on the windward side of the island.

CENCHREA EXQUISITA, sp. nov.

More robust and with wider wing-covers than *C. dorsalis*; yellowish white, darker on the upper surface of the body. Vertex a little narrower in front, projecting slightly in front of and above the eyes, the margins strongly elevated, curved and ribbed on the inner side; front long, parallel-sided, white, but more or less yellow above, deeply concave, the clypeus margined and terminated with black; rostrum reaching nearly to the posterior coxæ; the inferior cheeks very wide, pale yellow. Pronotum a little projecting into the curve of the head, short, broadly excurved behind, with the sides broadly expanded and concave; mesonotum a little tawny, convex, carinate on the middle and impressed each side thereof, the scutellum with an orange spot at the base, a large reddish one next the inferior apical angle, a long white spot back of the disk marked with four black dots, a faint streak on the costa beyond the middle, a more distinct short band nearer the apex, another, more oblique, next the apex, and a few traces on the apex more or less black, the veins mostly white; in front of the white spot one or two black specks are usually present. Wings clear white. Legs ivory-white, the anterior tibiæ and tarsi a little dusky. Underside and venter whitish, powdered; tergum dull yellow, powdered with white.

Length to end of abdomen 3 mm.; expanse of wing-covers 9 mm.

Six specimens of this brightly marked species were collected by Mr. H. H. Smith, near Kingstown and in other parts of the island.

Prosotropis, gen. nov.

Robust, in form of body similar to *Cercopis*. Head with the eyes hardly one half as wide as the pronotum, the vertex a little longer than wide, feebly carinated each side, the eyes large, round, and closely enclosing the vertex; the front long and wide, the sides broadly curving and distinctly carinated, the middle line also carinated; clypeus broad at base, with thick margins there, then acutely tapering to tip, the surface less prominent than the front; rostrum reaching to the middle coxæ. Antennæ stout, moderately short. Pronotum transverse, a little shorter than the head, a little arched, the base almost straight. Mesonotum large, convex, much wider than long, with the scutellum triangular and almost equally long, and the margins recurved. Wing-covers wide, obliquely narrowing towards base on the inferior side; veins few and mostly wide apart; the costal area wide, long, and growing wider towards the tip, which is bounded by a transverse oblique vein and crossed farther inwards by two veins which are oblique in the opposite direction; the apical series of areoles begins beyond the nodus with a large subtrapezoidal areole with a curved inner vein, the next outwards smaller with the inner angle acutely curved, the following one is triangular, shorter and smaller; the middle areole is very long and narrow, after this is a triangular areole, followed by a very long, curved, nearly wedge-shaped one, and on the inferior margin the areole is curved triangular, with the point directed against the tip of the clavus; the anteapical series is designated by two cells with curved veins. Abdomen broad, moderately convex, wider than thick.

Prosotropis decorata, sp. nov.

General colour fulvous, marked with large areas of dark brown. Head rather close set against the thorax, moderately convex, dull fulvous, the base prominently reflexed, with two indented points in front of the elevation; front dark brown, the clypeus and rostrum pale piceous; eyes convex, dark brown; antennæ wax-yellow. Pronotum dull pale brown, placed almost erect; mesonotum prominently convex, blackish brown, paler on the pleural portion. Scutellum almost equilateral triangular, pale yellow, depressed in the middle. Wing-covers transparent, with a tinge of yellow behind the middle, milk-whitish on the apical third; the veins pale brown, but interrupted with white on the apical division, an irregular brown stripe runs out from the base to near the middle, a double spot forms a bent band running diagonally back from the costa, and a curved triangular spot of the same colour runs inward from the apex, the nodal end of the band is bounded inwardly by a white vein. Wings obscure hyaline, with brown veins. Legs and posterior portion of the sternun yellowish. Tergum fulvous at base, the post-dorsolum pale yellow, from thence to behind the tip piceous; venter flat, bright red, marked with series of dark brown callous spots, the margin also dark brown, which colour extends upon the genital segment and its attachments.

Length to tip of venter 3 mm.; expanse of wing-covers 5½ mm.

Three specimens, mostly in poor condition, were collected on the island.

Fam. FLATIDÆ.

ORMENIS CONTAMINATA, sp. nov.

Obscure whitish yellow, or pale fulvous, covered with white powder when mature. Vertex almost truncated, the middle carina of front constituting a little angle at the summit, the lunate pronotum capping the vertex almost to its front border; front barely wider than long, subquadrate, depressed, with the sides curved and the lower angles a little rounded; clypeus long, prominent, triangular, with a broad blunt carina on the middle line, acute at tip; the rostrum reaching behind the posterior coxæ. Mesonotal shield covering nearly the whole upper surface of the mesothorax, the anterior portion forming a long rounded lobe, and the posterior division constituting a blunt triangle, terminated by a very short scutellum; the disk oval, bounded on the sides by carinate lines, and having a carina on the middle. Wing-covers nearly parallel-sided, the width across the tip only a little more than across the middle of the clavus with the corium; the veins very numerous, those of the disk nearly all forked, the apical ones mostly straight, parallel and simple, the series on the border of the inferior apex diagonal, those of the costal area numerous and straight; the postcostal area is occupied in great part by fine reticulated veins; the clavus is covered with coarse granules, another set occupies the basal angle of the costal area, and the inner middle base of the corium is set with a patch of finer granules; wings either white or smoky, with darker veins. Abdomen compressed.

Length to tip of abdomen 5–6 mm.; expanse of wing-covers 15–16 mm.

Ten specimens were collected at various localities on the island.

This is an exceedingly variable species as regards colour and pattern of marking. One specimen is mostly white, with a band of fuliginous on the apex of the wing-covers. Between this and the variety with a large triangular dark spot on the apical half of the pale tawny wing-covers there is a series of several degrees of expanse of the dark colour. The wings vary from pure white to dark lead-colour. I do not find any important differences to separate this from a species which is quite common in northern Mexico, Arizona, Texas, and California, and which approaches *O. mesochlorus*, Walker, from Cuba; but this latter has broader wing-covers and a longer, more prominent vertex.

SCARPOSA, gen. nov.

Robust, wing-covers decumbent, nearly twice as long as wide, broadly arcuate from base to behind the middle, then sinuated and narrower to the apex. Head viewed from above wider than long, the vertex with an excavation which widens anteriorly, each side of this is an indentation bounded exteriorly by the arched carinate margin; cheeks nearly flat, extended widely in front of and below the eyes, grooved above next the reflexed margin, callous next below; front subtrapezoidal, barely wider than long, longitudinally tumid each side, impressed in the middle, grooved against the raised lateral margins, a little sinuated above, with a narrow callosity at the summit; clypeus long, acutely tapering, the margins reflexed. Eyes small, globular, prominent. Antennæ short, bluntly rounded at base. Pronotum semicircular, but little longer than the vertex, sinuated at base, with the lateral flap triangularly produced against the eye. Mesonotum wide, a little wider than long, almost flat, the anterior margin bluntly triangular; the sides rectangularly triangular, and posteriorly longer, more converging, and forming a triangle with the short scutellum; the middle line obsoletely carinate, and the margins of the disk thick and set with two callous knobs. Basal margin of clavus convexly inflated, with the submargin carinately crested, and together with the inner margin forming an arch, the clavus behind this tapering narrowly back to the base of the membrane, the surface more or less granulated to near the tip; corium with wide and long areas which are crossed by mostly indistinct reticulations behind the middle, but with distinct oblique and irregular veins beyond the middle of the postcostal area, veins of the wide costal area numerous and moderately oblique, almost the entire surface sprinkled with callous granules; veins of the subquadrangular membrane curving in various directions and forming crowded and irregular cells, the apical series composed of subquadrangular areoles of larger size which are narrower above the middle. Posterior tibiæ grooved, armed with two stout spines below the middle. Abdomen blunt, subconical.

SCARPOSA TUMIDA, sp. nov.

General form of *Ormenis*, but tumid at the base of the wing-covers, with the costal region expanded in a wide curve, greenish. Head above with an obscure brown broad stripe which is carried back upon the mesonotum, the lateral raised margins highly polished, pale fulvous; front with a brown cloud above, pale testaceous below and including the clypeus; rostrum reaching to the posterior coxæ. Pronotum greenish yellow on the sides; mesonotum dull testaceous each side, with the two callosities dark brown. Beneath and legs tawny yellow. Wing-covers greenish, the inner ridge and margin of the clavus, besides a streak near its tip and the granules near the tip, blackish; corium in the angle behind base of costa, a spot at and broad stripe beyond on the the inner area, a broad less distinct band across the middle including the veins, a bent diagonal stripe running back from the lower angle of the apex, the almost truncate margin of the apex, one or two spots near the upper angle, and the granules of the costal area black or dark brown. Outer border of the venter red.

Length to tip of abdomen 5–5½ mm.; length to tip of wing-covers 7–8 mm.

This genus comes next to *Cyarda* in its general features, but the venation of the wing-covers is more open, varied, and simple, and the narrowed apex is not much protracted.

Two specimens were secured on the island. One of these lacks the broad band across the middle of the wing-covers. The acute knob near the base of the radial area is more prominent in the female than in the male.

ACANONIA SERVILLEI, Spin.

Three specimens, of somewhat smaller size than the average of those from Florida and Cuba, were collected on the leeward side of the island.

Fam. JASSIDÆ.

XEROPHLŒA VIRIDIS, Fabr.

Five specimens were taken on the island by Mr. H. H. Smith. This and the following species were determined by Mr. W. H. Ashmead.

XEROPHLŒA GRISEA, Germar.

Four specimens of this insect were captured on the island. These insects are so variable, and our knowledge of them is so insufficient at present, that there is no settled standard by which to gauge the species. I am in doubt as to this being the true *X. grisea* as described by Germar, and figured by Burmeister in his 'Genera Insect.' The figure is that of a species with more acute and longer head, and with an absence of most of the markings present in the species from St. Vincent.

GYPONA ALBOSIGNATA, sp. nov.

Dark straw-yellow, remotely marked with small spots, streaks, and flecks of brown; form of *G. irrorella*, Spangb. Vertex short, bluntly rounded; ocelli placed a little before the middle and nearer the eyes than to one another; the front margin reflexed, with the submargin depressed, the surface minutely and obsoletely wrinkled; the occiput indented each side on a line with the ocelli; front longitudinally depressed. Eyes brown. Rostrum testaceous, reaching behind the anterior coxæ. Pronotum more than twice as long as the vertex, transversely wrinkled, with an arc of flecks and short streaks behind the anterior margin, a cloudy stripe each side of middle, and a darker oblique spot near each posterior angle brown. Wing-covers pale testaceous, with orange veins, a tinge on the base of the costa, a brown ragged spot beyond its middle, a series of small flecks on the first ulnar areole, several larger ones next the apex; the transverse veins, a bent line on the inferior base of the membrane, and a spot at base and near the apex of clavus, besides its posterior edge, also brown, the apex of the principal areole and the tip of the clavus milk-white. Wings smoky, with dark brown veins. Scutellum with a brown triangular spot in each basal angle and some irregular streaks on the middle (the spots and marks partly or entirely absent, or coalescing, in some specimens). Body beneath and the legs pale testaceous, more or less powdered with white, the bases of tibial spines marked with a brown dot; apex of tibiæ and sometimes the ends of tarsal joints, and nails, brown. Tergum more or less brown, occasionally black on the three or four posterior segments.

Length to end of abdomen, ♂ 6, ♀ 7½ mm.; to tip of wing-covers 7½–8½ mm. Width of pronotum 2–2½ mm.

Three specimens were taken on the island. Two of these are females and one is a male. The male is paler and much less marked with brown than the others. This species inhabits the coastal plain of the United States and is found as far north as Cape Ann, Massachusetts. It is likewise variable in the United States.

GYPONA ANGUSTATA, sp. nov.

Narrower than usual, pale apple-green when fresh, pale yellow when dried. The vertex narrowly, subacutely rounded at tip, and moderately depressed, about two-thirds the length of the pronotum; the ocelli rufous, placed before the middle and a little farther apart than distant from the eyes; surface obsoletely wrinkled. Pronotum transversely wrinkled, hexagonal, the anterior margin bluntly semicircular and carried between the eyes. Underside and legs whiter than the upper surface, with the nails and apex of tarsi brownish. Wing-covers narrowing towards the tip, the basal portion obsoletely punctate near the veins, the basal areole sometimes with a minute black dot at base; veins mostly straight and simple, margin of costal areole whitish;

the wings milk-white. Last ventral segment of the female much longer than the preceding one, the tip rounded and slightly sinuated each side; last ventral segment of the male about twice as long as the penultimate one, subtruncate at tip, with the sides cut a little diagonal; the inferior appendages not much longer than the last segment, coarsely punctate, slightly grooved.

Length to tip of venter, ♂ $4\frac{1}{2}$, ♀ $5\frac{1}{4}$ mm.; to tip of wing-covers 6–7 mm.

Five fairly perfect specimens are in the collection made in St. Vincent by Mr. H. H. Smith.

This species is smaller and narrower than the *G. angulata*, Spangb., to which it bears much resemblance, besides the fact that in this new species the head is longer and the ocelli are nearer the anterior margin. It appears almost exactly like *G. placida*, Uhler, but in that species the last two ventral segments of male are long and of nearly equal size, and the upper genital attachments are abruptly narrowed beyond the middle, become acute at the tip, and are hairy, and not punctate.

Tettigonia (Proconia) rubricosa, sp. nov.

Form of *Proconia circumducta*, Signt. Carmine-red, the general form tapering posteriorly. Head orbicularly tumid, polished, varying from piceous through red to pale fulvous; front long, tumidly convex, having a few indented points superiorly; the eyes large, brown, and prominent, the surface at their inner angle indented; the occiput carinated on the margin and depressed before it; clypeus tumidly convex, distinctly separated from the front by the impressed line at base. Pronotum large, polished, wider than long, convex, strongly advanced in a broad curve upon the head, the submargin depressed; colour fulvous, paler in front, sometimes rufous and clouded posteriorly; sternum and pleural segments pale yellow, sometimes tinged with brown, powdered with white. Legs pale brownish yellow, with the spines, tip of tibiæ, and apex of tarsi, including the nails, brown. Scutellum tawny or red, acuminate; the underlying dorsal segment dark, bordered with testaceous. Wing-covers narrow, tapering, curving to an acute tip, bright red, spread with blue, which omits the base, borders, veins, and tip; cells of the membrane large, long, and few; wings smoke-colour, with the veins darker. Abdomen red, slenderly tapering, with a pale blue band at apex of the last tergal segment; last ventral segment of female broadly sinuated, with the outer corners acutely triangular; the same segment of male truncated.

Length to end of abdomen 6–7 mm.; width of pronotum 2 mm.

Eight specimens of this brilliant species were taken near Kingstown at altitudes ranging from 1300 to 2500 feet above the sea.

Tettigonia (Proconia) fastigiata, sp. nov.

Head wide, more triangularly curved at tip than in the preceding species; ground-colour black above, pale yellow beneath. Vertex highly polished, convex in the middle, transversely impressed at base, black with a yellow tip and a broad yellow band across the middle; front yellow, oblique, convex, polished, separated from the clypeus by a deep suture, the clypeus short, tumidly convex, pale testaceous, the rostrum also testaceous, stout, reaching to the middle coxæ. Pronotum hardly longer than the head, transverse, moderately convex, the lateral margins a little oblique, curved, the anterior margin bluntly curved and carried nearly half the length of the eyes into the base of the head; the colour black with a broad lunate yellow band behind the anterior submargin, the posterior margin feebly sinuated. Scutellum equilaterally triangular, subacuminate, bordered with yellow. Legs pale testaceous; the spines, tip of tibiæ, and end of tarsi brown. Wing-covers with three long yellow stripes, besides a cuneiform spot near the tip, outside of which is a transverse curved large spot, and the superior apex broadly and obliquely covered with yellow, which spreads from the costal area; the costal margin reddish; veins slender, forming few and large areoles near the tip. Abdomen strongly tapering; tergum bright red, sometimes fulvous at tip; the last ventral segment hardly longer than the preceding one, hardly sinuated; inferior genital valves uniting to form a long cornute appendage, coarsely punctate, set with stiff bristles, and curved down on the acute tip.

Length to end of abdomen 5½–6 mm.; width of pronotum mm.

Six specimens of this showy species were secured near Kingstown and on both sides of the island. The specific name was suggested by the rod-like pack of stripes on the wing-covers. These organs are blunter than in the preceding species, and the wings are smoky brownish, paler on the anterior margin, and the veins are darker.

TETTIGONIA (DIEDROCEPHALA) SAGITTIFERA, sp. nov.

Form of *D. flaviceps*, Riley, sage-green above, pale greenish yellow beneath. Vertex with the sides a little rounded, the apex triangular, with the immediate tip a very little blunt; colour pale orange, with an irregular whitish spot around the black ocelli connected with an oblique stripe running forward to meet its fellow at the apex of the arrow-shaped black spot on the tip of vertex; base with a pair of small white spots on the middle, space near the antero-lateral border with three small spots, and the supra-antennal plate also white; front oblique and convex, dusky, dotted with pale yellow, the very summit smooth whitish; clypeus small, convex, pale testaceous; the rostrum reaching to the middle coxæ, brown at tip. Pronotum shorter than wide, bean-shaped, a broad lobate pale spot in front on each side, connected in the middle by a band of the same colour, and carrying a line of dark brown dots near the anterior border, the posterior border a little emarginate in the middle; the surface closely rugulose. Scutellum yellow, with a black spot at each basal angle, and sometimes two minute dots on the depressed middle. Wing-covers slightly tapering, narrowly rounded at tip, with the veins and margins yellow, the apex more broadly dull yellowish; wings smoke-brown, with the veins darker. Tergum blue-black, pale at base, yellow on the sides, at tip, and on the edges of some of the segments; venter bright yellow posteriorly; last ventral segment longer than the preceding one, a little wider behind, truncated.

Length to end of venter, ♂ $3\frac{1}{2}$, ♀ 4 mm.; width of pronotum $1–1\frac{1}{4}$ mm.

Numerous specimens of this insect were taken in various parts of the island. This species varies in the size and form of the black dot on the front of vertex and in the number of yellow marks on the same. Occasionally the upper border of the front is also slenderly yellow.

TETTIGONIA HERBIDA, Walk.

More than thirty specimens of this bright green species are in the collection from St. Vincent. This species is equally common in the islands of Cuba and Trinidad; but we have not yet seen specimens of it from the mainland of South America.

SCAPHOIDEUS STIGMOSUS, sp. nov.

Pale fulvous; form similar to *S. scalaris*, Van Duz., but with a longer and wider head, and antennæ nearly as long as the wing-cover. Vertex a little longer than its width between the eyes, almost flat, very pale fulvous, with a series of brown dots around the anterior submargin and some less regular ones on the middle, occasionally with two or three ivory-white dots before the middle; front irregularly clouded with pale brown, bounded above by a slender dark brown line. Clypeus broad, bluntly rounded, marked with a brown subapical spot; the rostrum reaching to the middle coxæ. Eyes with a dark brown band below. Antennæ dark brown, paler at base. Pronotum triangularly sublunate, well advanced into the deeply sinuated vertex, the surface minutely scabrous, transversely wrinkled, polished, dotted with pale yellow anteriorly, and minutely speckled with the same colour behind the middle; the posterior angles subacute, a little produced, the posterior margin slightly sinuated. Scutellum with a dark brown spot in the basal angles; the disk a little marbled with brown. Wing-covers marked with three brown spots on the inner margin of the clavus, each of which has an acute white spot at the tip; veins white interrupted with brown, margins pale; the costal margin has a series of broader white streaks adjoining it inwardly, four large apical cells pale at base, bounded by brown veins, the apex a little dusky; wings smoky, with dark brown veins. Beneath and legs pale yellow, the tibiæ somewhat marked with brown; the tarsal joints, nails, and spots at origin of the tibial spines dark brown; the spines pale brown. Last ventral segment of the female deeply notched, the valves of ovipositor set with long, brown, stiff bristles; tergum blackish, with pale edges to the segments and a pale tip.

Length to end of venter $3\frac{1}{4}$ mm., to tip of wing-covers 5 mm.; width of pronotum 1 mm.

Five specimens, all females, were secured on the island. One was taken at an altitude of 1500 feet above the sea, and two were collected at Kingstown.

DELTOCEPHALUS VIRGULATUS, sp. nov.

Form short, robust; head bluntly subconical, black, striped with green, polished; the wing-covers coriaceous throughout, wide at tip and bluntly rounded. Head of about the same length as pronotum, the vertex hardly separated from the front, depressed at base, where it is crossed by a pale green band; front convex, dull black above, green across the end, and there forming a part of the broad band which covers all but the tip of the clypeus and tip of the wide cheeks; rostrum orange, reaching to the middle coxæ. Pronotum transverse, convex, curved over the head to before the middle of the eyes, minutely wrinkled, crossed by a green band which covers most of the surface and sometimes includes the posterior margin. Scutellum dull black, transversely incised, pale at tip. Legs black, the posterior tibiæ with pale spines, and the tarsi more or less pale. Pleural segments more or less marked with pale green. Wing-covers thick, coarsely scabrous, and obsoletely punctate, so broadly marked with green as to give predominance to that colour, the black shows as a broad apical border; a wide angular spot curving apically from the costal border, a streak near tip of inner areole, an oblique stripe at outer border of clavus, a spot at base of corium, and a streak at base of clavus, all black; wings smoky. Venter black, the edges and outer border of segments pale greenish; last segment of male sinuated, genitalia blunt.

Length to tip of wing-covers $3–3\frac{1}{2}$ mm.; width of pronotum 1 mm.

Eight specimens of this peculiar form were taken on the island. It is quite variable in the proportion and distribution of the green colour upon the upper surface, and especially on the wing-covers. Specimens of one or other of its several varieties have been sent to me from Cuba, Florida, Eastern North Carolina, Central Illinois, and Para, Brazil. I have also found it myself on plants in low grounds in Eastern Virginia, New Jersey, and on both shores of Chesapeake Bay, Maryland, in July and August.

DELTOCEPHALUS RETRORSUS, sp. nov.

Fuscous or blackish, more parallel-sided than the preceding species. Head short, obtusely triangular; vertex depressed at base, tumidly elevated at tip, pale brownish yellow, with a slender black stripe on the middle at base; an indented black spot each side behind next the eye, an interrupted band across the middle and a narrower one next the tip also black, the middle and interval between these bands and the very tip pale green; front convex, black, minutely rough, with about three series of pale minute specks; cheeks partly bordered each side with pale green; rostrum pale greenish, short, black at base. Legs pale yellowish, the inside and tip of posterior tibiæ and bands on the tarsal joints brown. Wing-covers smoke-fuscous, pale on the centre of all but the apical cells; costal border ivory-yellow, including two short black stripes near its tip, following which the superior apical cell is black, and the next below only a little less deep black, the inferior one still paler, these three bounded on the sides by brown veins, the other veins pale yellow; areoles of the clavus each with a dark brown stripe on the inner border; wings faintly smoky, with dark veins. Pronotum short, broadly curved in front, polished, minutely wrinkled, marked anteriorly with a transverse series of yellow dots, sometimes provided with five incomplete pale stripes; the dorsolum bordered with a square yellow lineation, followed directly behind by the triangular scutellum margined also with yellow. Abdomen brownish or black, the segments generally with pale edges, and the male usually darker than the female. The superior genital pieces of the male nearly triangular, the inferior ones uniting to form a longer subacuminate triangle bordered with yellow; the valvular segment at base of these is triangular and a little curved on the sides; genital pieces all armed with brownish long bristles.

Length to tip of wing-covers $2\frac{1}{2}$–3 mm.; width of pronotum 1–$1\frac{1}{4}$ mm.

Five specimens of this odd little species were taken at various places on the island. It is a common North-American form which is distributed all the way from Florida, along the coastal plain, to northern New Jersey. It varies much in depth and extent of colour, and somewhat in the degree of bluntness of the tip of vertex. In Maryland it rests upon the leaves of bushes and occurs from August to October in sunny situations.

DELTOCEPHALUS CUNEATUS, sp. nov.

Robust, brownish or black, marked with pale green above. Form similar to the preceding species. Vertex bluntly rounded, a little longer than wide between the eyes, yellowish green, marked anteriorly with two large black dots, and farther back with two minute ones; eyes large, not prominent, but extending far back to complete the deep sinus of the occiput; front long, moderately convex, with two broad stripes, which occupy most of the width or are interrupted by oblique bands; clypeus with a black dot each side; the rostrum short, fulvous. Pronotum very short, lenticular, pale green, with an anterior impressed blackish submargin. Scutellum bluntly carinated on the middle, marked with black before the middle, and twice indented there. Coxæ mostly black; femora and tibiæ dull testaceous, obscurely striped with brown, the tarsal joints more or less marked with brown. Pleural segments blackish, partly marked with green; wing-covers a little curved on the costal margin; the clavus pale green with a brown edge on both margins, the costal area also green, this colour sometimes overlapping the adjoining areole, the interval between this stripe and the clavus, including the subapical area, smoke-brown; the apex paler, with the veins darker. Wings almost transparent, with the veins pale brown. Abdomen black, the segments edged and bordered exteriorly with greenish white. Inferior genital segment of the male triangular and swollen.

Length to tip of wing-covers 2–2½ mm.; width of pronotum 1–1¼ mm.

Twelve specimens were taken at two or three places on the island.

Deltocephalus acuminatus, sp. nov.

Pale greenish, moderately robust. Head short, subconical, with the sides curved; vertex a little longer than wide, marked with two deltoid black spots next the tip, near the base are two very minute black dots: eyes long and very oblique; front oblique, convex, crossed by two series of slender, curved, brown lines, the lower margin, a spot on the tylus, and some specks on the cheeks also brown. Pronotum short, green, and a little rugose, yellowish in front, the submargin with two black dots, each side of which are some minute specks, the anterior margin moderately curved, the posterior margin subtruncate, and the lateral margins broadly oblique and curved. The scutellum a little scabrous, impressed in the middle, pale greenish, with a slender point at the apex. Wing-covers pale greenish yellow, translucent, narrow, moderately curved: the veins prominent, mostly straight, with long areoles, the costal areole and the adjoining one, besides the clavus, remotely punctate. The legs pale dull yellowish, with the bases of the tibial spines, tip of tibiæ, and bands upon the tarsi brown. Sternum black, the pleural segments more or less margined and marked with pale green. The venter broadly black at base, this colour narrower and interrupted by green on the posterior segments; tergum covered by black at base, with the segments very slenderly edged with pale yellow, the apical half pale straw-yellow, dotted with black on the middle and submarginal lines.

Length to tip of wing-covers 3–3¼ mm.; width of pronotum 1 mm.

A few specimens, females, were brought from the island by Mr. Herbert H. Smith. The wings in this species are milk-white.

Deltocephalus colonus, sp. nov.

Similar to the preceding species in form, but with a blunter head, marked with two black dots placed far apart, and usually with two minute dots on the tip. Colour smoky yellowish or dull straw-yellow. Vertex hardly triangular, the sides bluntly curved; front long, pale testaceous, marked with a dagger-shaped middle line which extends from the tylus to the summit of the front, each side of this is a series of about eight narrow black bands, of which the upper is broader and arcuated; the exterior margin, edge of the middle line, and sutures also black, or brown; the cheeks sometimes marked with a few brown specks. Pronotum short, longer than the vertex, transversely rugose and impressed, bluntly rounded in front, the posterior margin short and subtruncate. Scutellum bluntly triangular, hardly acuminate, with a few impressed dots scattered over the surface. Wing-covers almost transparent, a little curved, the veins thick and pale yellow, the general surface a little dusky, with a darker streak behind the pale yellow costa, the veins long and regular. Wings a little smoky, with brown veins. Legs pale dull yellow, with the tarsal joints and nails brown. Sternum and venter dark, often black in the male, with the sutures and margins pale; genital segments of the female pale yellowish; tergum mostly black, with a band of yellow next the tip, and the edges of the segments pale; genital valve triangular, subacute at tip, the two following pieces uniting to form a long, subconical segment with a rounded tip, and armed with stiff, brown bristles.

Length to tip of wing-covers $3\frac{1}{4}$–$3\frac{1}{2}$ mm.; width of pronotum $1\frac{1}{4}$ mm.

Numerous specimens of this species were collected on the island by Mr. Smith. Both of the foregoing species belong to a little group of forms which abound on the marshes and low meadows of the Southern United States, and which deviate more or less in venation and form of wing-covers from the types of *Deltocephalus*. They can hardly be referred to *Cicadula*.

AGALLIA USTULATA, sp. nov.

Form of *Agallia quadripunctata*, Prov. Mostly brown above, and black beneath. Vertex short and blunt, pale yellowish, with a large black dot each side, a brown interrupted stripe near the eyes, a line widening anteriorly on the middle, the anterior margin and a line running inward to the ocellus, also brown; front suboval, convex, with a divided fulvous margin above, the lateral margins and two short stripes near the clypeus also tawny; the middle line of cheeks, interruptedly, a triangular border at base of tylus, and the rostrum pale testaceous. Pronotum moderately short, with the sides very oblique and the anterior margin bluntly curved, coarsely punctate; the colour yellowish with a brown transversely oval line on the middle, this is divided by a dagger-shaped stripe which has an oblique streak each side of it, each side of the oval ring two oblique lines are protracted towards the outer margin, also brown, the posterior margin is often black. Scutellum black, long and acute, pale towards the tip, each basal angle with an ivory-yellow dot. Sternum and pleural pieces black, the latter margined with pale fulvous. Legs pale testaceous, striped with dark brown, the tarsi banded with piceous. Wing-covers mostly brownish, testaceous on the outer half of corium and entire membrane, the veins dark brown; clavus margined on both sides with pale testaceous, which is more or less interrupted by the brown of the areoles; middle of corium partly crossed by a brown band which bends forwards exteriorly and admits an ivory-white short streak; near the base are several small pale spots and streaks, and on the membrane a few whitish oblong spots, ends of the three veins touching the claval margin broadly ivory-white. Abdomen black or brown, with the edges of the segments, lateral margins, and apical segments pale. Genital valve of male very short, bluntly rounded at the corners, the following segments composing a ligulate cover, rounded at the tip.

Length to tip of wing-covers 3–3¼ mm.; width of pronotum ¾ mm.

This is a variable species, in which all the specimens at hand differ from each other in amount and pattern of marking; the paler specimens lack the brown ring on the vertex, and have that colour broken up in various figures.

AGALLIA NIGRICANS, sp. nov.

Black, polished, the tip of head a little more triangular than in the preceding species. Vertex with a large black spot each side, a line on the middle, two smaller dots below the upper ones, the inner border against the eyes, and a band on the forward margin also black; front suboval, black, marked with traces of pale fulvous on the middle and sides, tip of clypeus also fulvous; cheeks moderately wide, bordered and striped with pale fulvous; rostrum piceous, paler at tip. Pronotum much longer than the vertex, obsoletely and minutely scabrous, feebly impressed each side, black, sometimes with two large fulvous spots at base, and usually with two small diagonal ones on the middle. Scutellum short, with a spot in each basal angle and the margin ivory-white. Legs more or less black, the coxæ, knees, base and apex of femora, and underside of posterior tibiæ pale fulvous. Wing-covers black, or brownish with the veins darker, the costal vein pale yellow; veins of the clavus and base of corium a little interrupted with fulvous, origin of the corium and a short stripe a little farther beyond ivory-white, the two middle apical cells longer than wide, subquadrangular. Abdomen mostly black, robust and not tapering in the male.

Length to tip of wing-covers 2½–2¾ mm.; width of pronotum ¾ mm.

Eight specimens of this dull-coloured species were collected on the island.

AGALLIA FASCIGERA, sp. nov.

Pale yellow, robust, with a wide head and somewhat wedge-shaped form. Vertex short, wide and blunt, with a black dot each side of the middle and sometimes a line in the centre; the front about one-half longer than its upper width, situated below the seat of the antennæ, scarcely separated from the vertex, pale soiled yellow, stained brown above and on the margins; superior margin regularly curved, terminating each side in an angle above the antennæ; cheeks moderately broad, pale; apex of tylus brown; rostrum long, pale testaceous, brown at tip. Pronotum transverse, broadly curved on the sides posteriorly, the anterior margin very broadly curved, the fine punctures almost effaced; the posterior submargin with a dark line which ends each side in a black oblique spot, the anterior margin sometimes fuscous. Scutellum faintly scabrous, a little clouded with brownish. Legs pale dull testaceous, the tarsi piceous at tip. Wing-covers light yellow, occupied by slender oblique black, usually complete, lines; the apical margin dark brown, with the two middle areoles long and straight; the veins yellow; wings a little smoky, the veins dark brown. Abdomen pale yellow, the tergum broadly black on the middle. Male genital valve long, collar-like, the following pieces liguliform.

Length to tip of wing-covers $3\frac{3}{4}$–4 mm.; width of pronotum $1\frac{1}{8}$ mm.

Three specimens were captured in St. Vincent. One was found in the mountain forest in July at an altitude of 2000 feet, another occurred at 3000 feet, and the third was secured in June.

Agallia capitata, sp. nov.

Head wider than in the preceding species; colour yellow, spread and striped with dull black. Vertex blunt, moderately short, marked with two small black dots parallel to the ocelli, and the ocelli placed on larger dots which are connected by a dark brown band, a longitudinal streak crosses the band; front long, sinuated each side below the curved summit, almost covered by a blackish stripe which keeps on to the tip of the tylus; superior cheeks yellow, inferior ones narrow, blackish; rostrum fulvo-testaceous, long and slender. Pronotum transverse, distinctly punctate, yellow, crossed near the base by a black band between two large spots; the middle line black, wrinkled; the anterior margin broadly curved, narrowly brown. Scutellum dull yellow, brown on the middle and at base, the tip long acuminate. Legs pale testaceous, with a black speck at the knees, and the tip of tarsi brown. Wing-covers smoke-black, with a long subfusiform hyaline stripe occupying nearly half the width of the corium from the costa inwards and extending from near the base to next the tip and surrounded by a black border including the costa, the remaining surface with long narrow yellow lines, including the veins and sutures; wings smoky; with the veins darker. Disks of the sternal and pleural pieces blackish. Venter pale yellow; the tergum black, with the base, tip, and edges of the segments yellow. Male genital valve long, collar-like, with the attached pieces slender, long, cerciform.

Length to tip of wing-covers $3\frac{1}{2}$ mm.; width of pronotum 1 mm.

Only two specimens of this peculiar species were brought from the island. It bears some resemblance to the preceding species, but, apart from the broader form and peculiar markings, it may be at once recognized by the slender process at the tip of its scutellum.

AGALLIA ALBIDULA, sp. nov.

Pale fulvous, robust, with the head a little more convex than in *A. fascigera*. Vertex of medium length, convex in front, either pale fulvous, or yellow tinged with green, obsoletely marked with testaceous spots, a brown dot on each side of the summit, on a line with the paler brown ocelli; surface sericeous, not punctate, obsoletely incised on the middle; front narrow and scarcely one-half longer than width of base, the summit distinctly triangular, the lateral basal angles triangularly produced, emarginated beneath this, middle with a pale spot near the summit, and a long oval pale spot inferiorly; superior cheeks dusky, spotted with yellow below the eyes, inferior cheeks yellow; tylus yellow, with a brown stripe on the middle; the rostrum long, slender, testaceous, piceous at tip. Pronotum transverse, of medium length, moderately convex, scarcely scabrous, faintly sericeous, pale testaceous, marked with a triangular pale brown spot each side, two dots near the front margin, a line on the middle, and sometimes two small spots near the humeral angles; the postero-lateral margins obliquely curved, the anterior margin regularly curved, causing the outer angles to be almost acute. Scutellum short, depressed and spoted on the middle, testaceous, with the tip acuminate. Legs dull testaceous, the apex of the tarsi, including the nails, piceous. Wing-covers faintly dusky; the veins, costal area, an angular mark on the tip of the basal areole, and a large oblong spot extending to the middle of the clavus yellowish white, the tip of this spot is bounded by a curved brown mark, the apical portion of the clavus dusky hyaline; base of the corium, two faint spots beyond the basal areole, two others on the middle, the apical margin, and the tip of the clavus pale brown; wings dusky, with dark brown veins. Tergum black on the disk and base; middle of venter brown. Genital valve of male triangular, the following pieces wide at base, tapering toward the end.

Length to tip of wing-covers $3\frac{1}{2}$–$3\frac{3}{4}$ mm.; width of pronotum 1 mm.

More than a dozen specimens, including incomplete states of coloration and texture of wing-covers, were taken at various localities on the island.

Besides the foregoing species, the collection from St. Vincent includes several small *Jassidæ*, related to *Typhlocyba*, *Chlorita*, *Alebra*, and *Zygina*, which cannot be satisfactorily determined for want of access to the types of the various authors who have described these insects.

3. On the Occurrence of the Barbary Sheep in Egypt. By P. L. Sclater, M.A., Ph.D., F.R.S., Secretary to the Society.

[Received January 11, 1895.]

Although Geoffroy St.-Hilaire is stated to have brought to Paris a specimen of the Barbary Sheep (*Ovis tragelaphus*), obtained near the city of Cairo (Savigny, Description de l'Egypte, vol. ii. p. 742 (1812), Mammif. pl. vii. fig. 2 (1809)), I have always supposed that some mistake had occurred as to this locality [1], as until recently I knew of no modern authority for its being met with, except in Morocco Algeria, and Tunis. As regards Tripoli I have no certain information, but I have been informed that a Wild Sheep is found in the interior of that country.

Last summer, therefore, I was rather surprised when I was told by Major Talbot, R.E., of the Intelligence Department, who had lately visited the frontier of Egypt at Wady Halfa, that several specimens of a Wild Sheep had lately been obtained on the banks of the Nile in that district. Major Talbot was kind enough to refer me to Capt. J. G. Dunning, who had been for some time stationed at Wady Halfa, for further particulars, and Capt. Dunning, at my request, supplied me with the following notes:—

"During the summer of 1890 a herd of some 13 Sheep, according to native accounts, were continually seen in the neighbourhood of Semneh, some forty miles south of Wady Halfa on the Nile, and on the east bank of that river. Several of these Sheep were shot by natives and brought into Halfa, the head sent from Assouan and the horns now at Mr. Rowland Ward's belonging to two of those shot.

"These Sheep had not been seen in that neighbourhood before, and have not been seen since, and it is possible that the drought which obtained in the Atbai very generally from the years 1886–91 forced these animals down to the Nile, as the water-holes and pools became dried up.

"They are supposed to come from the neighbourhood of Gebel Hisse (or Isse), some 60 miles to the S.W. of the Elba mountains. This mountain of Hisse or Isse is presumably the head of the Wady Allaki, which falls into the Nile some 40 miles north of Korosko."

Capt. Dunning, moreover, informed me that he was expecting to receive from Assouan a head of this Sheep, which would be at my service for examination. This, I am sorry to say, has never reached me, and, as Capt. Dunning has gone to Uganda, I have not been able to communicate with him about it. But I have examined a pair of horns at Mr. Rowland Ward's belonging to Major Lloyd, of the South Staffordshire Regiment (alluded to by Capt. Dunning), and have no doubt that they are those of a young male of *Ovis tragelaphus*. I think, therefore, we may assume it as proved that the present range of the Barbary Sheep extends through the interior of Tripoli into the southern mountains of Egypt.

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[1] There seems to be no doubt that the Barbary Sheep is represented on some of the ancient monuments of Egypt (see *Ammotragus tragelaphus* in Dr. R. Hartmann's article on the Animals figured by the Ancient Egyptians on their sculptures, in Brugsch's Zeitschr. f. Ägyptische Sprache u. Alterthums, ii. p. 23), but many non-Egyptian animals are figured in these drawings.

But I have two pieces of evidence which tend to show that the Barbary Sheep in bygone years existed also in the more northern mountains of Eastern Egypt between the Nile and the Red Sea. Mr. E. N. Buxton has shown me a large and well-preserved right horn of the Barbary Sheep, which he picked up in Feb. 1893 on the lower slopes of the mountains to the north of the Wadi Medisa, during his journey from Keneh towards Jimsah[1]. In such a dry climate it is impossible to say how long this horn may have lain there, but it is evidently comparatively recent.

Again, as Mr. Buxton has kindly pointed out to me, Prof. Schweinfurth, in an article "On the unknown Land of Egypt" (of which I have only seen a translation), speaks of the Barbary Sheep as being even now "frequent" in the Wadi Scietun, which debouches on the Nile below the town of Achmim (or Echmim) between Siout and Kenah. There is said to be a cistern in this valley about 60 kilometres N.W. of Achmim, to which these animals resort.

It is therefore by no means impossible that, as Geoffroy St.-Hilaire has stated, an example of *Ovis tragelaphus* may have been killed near Cairo at the beginning of the present century.

4. Note on the Breeding of the Surinam Water-Toad (*Pipa surinamensis*) in the Society's Reptile-House. By P. L. Sclater, M.A., Ph.D., F.R.S., Secretary to the Society.

[Received January 14, 1895.]

When I visited the Gardens of the Royal Zoological Society of Amsterdam in May last, as I have already mentioned on a former occasion (see P. Z. S. 1894, p. 456), I observed with great interest seven living examples of the Surinam Toad in one of the hot-water tanks, being the first individuals of this remarkable Batrachian that I had ever seen alive. Noting the interest that I took in these creatures, our excellent corresponding member Mr. F. E. Blaauw, who was in my company on the occasion, most kindly offered to endeavour to obtain for the Gardens of this Society some specimens of it from his family estates in Surinam, and shortly afterwards sent out there a drawing of the *Pipa*, to assist in its identification. The first specimens received by Mr. Blaauw in answer to his requisition turned out to be examples of the large S. American toad *Bufo marinus* sive *agua* (see Additions on the 19th of September, 1894, P. Z. S. 1894, p. 752).

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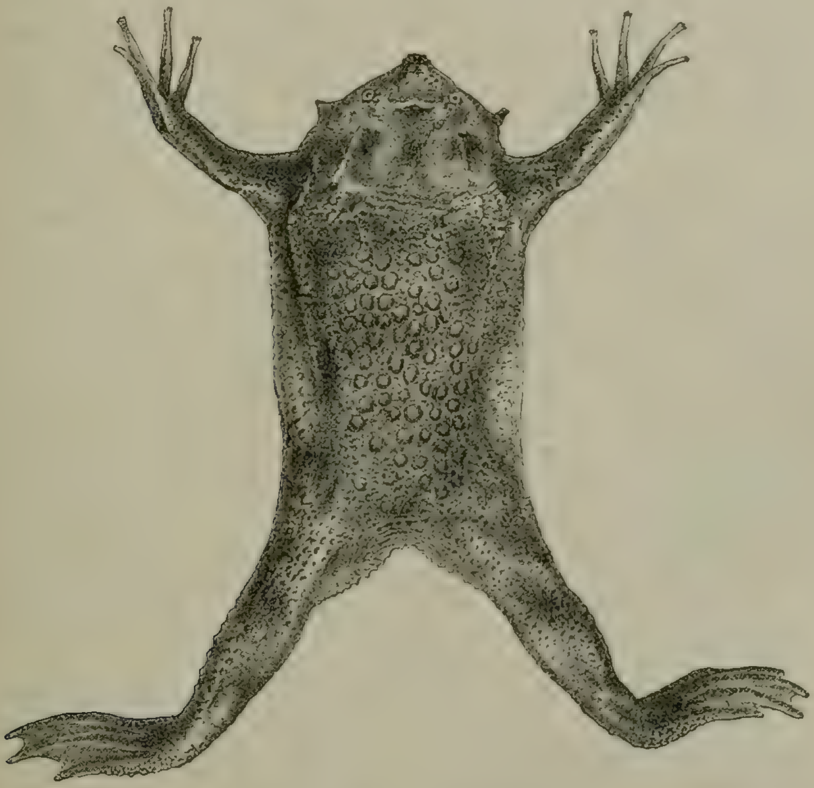
[1] See Mr. Flower's map, P. R. G. S. n. s. ix. p. 730 (1867).



Upper view of Surinam Water-Toad, showing the traces of cells on the back. (From a photograph taken Jan. 3, 1895.)

On a second occasion Mr. Blaauw was more successful, and on the 14th of November last handed over to me, as a present to the Society, ten living specimens of the veritable Surinam Toad—*Pipa surinamensis*.

The *Pipæ* on arrival were placed in the large hot-water tank in the right-hand corner of the Reptile-house, until recently occupied by the African Mud-fish, where the water is kept at a temperature of about 70° Fahr. I may here remark that this Batrachian, so far as our experience goes, seems to be purely aquatic, and never voluntarily emerges from the water. At the same time, when caught and put upon the ground it is quite capable of hopping about easily.

The *Pipæ* were supplied first with bits of worms and subsequently with small fishes, and fed freely. They improved rapidly in health and condition.

On December 1st two of them were observed by the keepers to be *in copulâ*, one holding on round the middle of the body of the other. They remained in this position about 24 hours. After they had separated it was noticed that the back of one of them had become covered with spawn. The ova were very regularly arranged in shallow pits or cells over the whole of the back and appeared to be 80 or 90 in number. After this the ova seemed to drop out gradually, so far as we could see by looking into the tank without capturing the animal, and by December 20th had mostly disappeared, leaving only three of the cells occupied by apparently living embryos. These were situated in a nearly straight line across the middle of the back, and were of a yellow colour—no doubt from the large yolk-sac under which they lay.

On January 3rd I thought it would be advisable to ascertain by close examination the exact state of the matter. On that day accordingly the *Pipa* was caught and placed in a small glass of warm water, in the presence of the Superintendent and Head-keeper and two of the Keepers at the Reptile-house. It was at once apparent that only one cell now contained an embryo, of which we could plainly see the heart beating. During the examination the embryo fell out of the cell, and it being impossible to replace it I had it placed in spirit, and now exhibit it.

I thought it best to take the opportunity of having the *Pipa* photographed, which was very successfully done by Mr. Briggs.

I now exhibit copies of this photograph (see p. 87).

I propose to place the embryo of the *Pipa* in our Prosector's hands for further examination and description.

In conclusion I must record my best thanks to our Head-keeper, Mr. Arthur Thomson, for his care of and attention to these Batrachians, and for the notes which he had supplied to me, and express a hope that some of the other specimens will breed and furnish us with more successful results.

February 5, 1895.

Sir W. H. Flower, K.C.B., LL.D., F.R.S., President,
in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of January 1895.

The total number of registered additions to the Society's Menagerie during the month of January was 39, of which 29 were by presentation, 1 by birth, 3 by purchase, and 6 were received on deposit. The total number of departures during the same period, by death and removals, was 110.

Mr. Holding exhibited and made remarks on the skull of a Three-horned Stag, the head of a Four-horned Ram, and the gnawed horn of a Red Deer.

The following papers were read:—

1. Contribution to the Knowledge of the Breeding-habits of some Tree-Frogs (*Hylidæ*) of the Serra dos Orgãos, Rio de Janeiro, Brazil. By Dr. Emil A. Goeldi, Director of the Museum of Natural History and Ethnography of Pará[1].

[Received January 1, 1895.]

1. Hyla faber, Wied.

Hyla palmata, Burmeister; *H. maxima*, Reinhardt et Lütken.

The "Ferreiro" ("Smith") is of common occurrence in the Province Rio de Janeiro, more frequently still in the mountain regions of the Serra dos Orgãos than in the hot lowland. At Colonia Alpina, near Theresopolis, I could be sure to pick up three or four individuals in less than an hour in the evening, guided to their retreats by their singular voice. In fact this voice is one of the most characteristic sounds to be heard in tropical South America. Fancy the noise of a mallet, slowly and regularly beaten upon a copper plate, and you will have a pretty good idea of the concert, given generally by several individuals at the same time and with slight variations in tone and intensity.

When you approach the spot where the Tree-Frog sits, the sound ceases. But keep quiet, and it will be resumed after a few moments. You will discover the frog on a grass-stem, on a leaf of a low branch, or in the mud. Seize it quickly, for it is a most wonderful jumper, and it will utter a loud and shrill, most startling cry, somewhat similar to that of a wounded cat.

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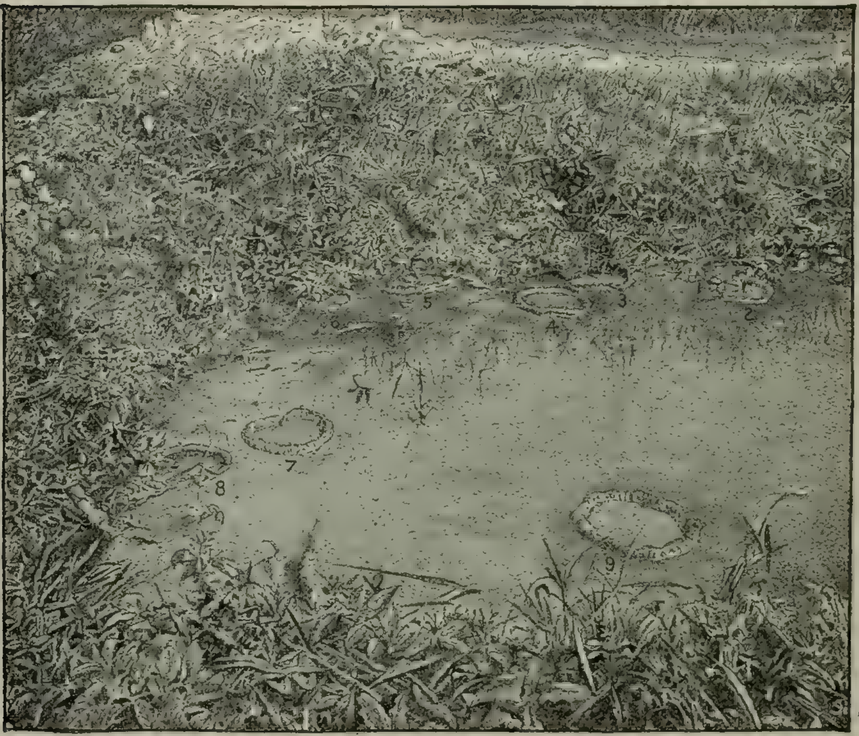
[1] Communicated by Mr. G. A. Boulenger, F.R.S.

With the assistance of my cousin, Andreas Goeldi, a good observer and keen collector, I undertook, during numerous nights in all seasons, a thorough investigation of the batrachian life at Colonia Alpina, Theresopolis. As nothing is known of the habits of this most familiar and striking Tree-Frog[1], I think it will be interesting to describe some of the more essential features of its breeding-habits, as we had occasion to study them in 1893, and again in the beginning of 1894.

The appended figure, from a photograph taken from a portion of the pond in the middle of our large kitchen-garden, in February of last year, will help to complete my efforts to give a clear idea of the architectural skill of our frog. The nests are numbered in the figure.

Fig. 1.



Portion of a pond showing nurseries of *Hyla faber*.

Hyla faber makes, in the shallow water of the borders of ponds and similar localities, very regular pools of a circular form, surrounded by a wall of mud—nurseries for the tadpoles. Nine of these nests or pools may be seen on the figure, and I shall describe how we witnessed their formation and subsequent use.

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[1] In 1886 Mr. Boulenger published, as a supplement to an article "On the Oviposition in *Phyllomedusa iheringii*" (Ann. & Mag. Nat. Hist. ser. 5, xvii. p. 463), a very useful synoptic table, containing the facts known at that time respecting the mode in which tailless Batrachians deposit or protect their offspring. *Hyla faber* is not mentioned.

For the purpose of cleaning and deepening, the pond had been nearly emptied the year before and was kept in this state till the beginning of 1894, the water in the centre being no more than from 3 to 4 feet deep. In the first days of February we noticed some newly made walled pools every morning. We had to wait for full moonlight to make our observations.

On the night of the 18th February, between 9 and 11 o'clock, we approached the pond, occupied, as we could hear from a distance, by at least a dozen of the large Tree-Frogs. The moon was shining brightly, and much favoured our undertaking, but even under these circumstances we had to accustom our sight to discern the details in the marginal vegetation and the portions somewhat hidden in the shadow. By and by we discovered the "ferreiros," some at work, others drumming together on the walls of some pool or in the middle of the pond, sitting upon some floating object, such as water-plants. The vocalists, the moderately inflated subgular vocal sacs of which we could distinguish, were males.

We were posted on the side where the nests nos. 1 to 5 are to be seen. From a distance not greater than 2 to 3 feet we could survey, with all desirable distinctness, the rising of nest no. 3. On that place we first saw some slight movement in the water, produced by something stirring below the surface. We then soon saw a mass of mud rising to the surface carried by a Tree-Frog, of which no more than the two hands emerged. Diving again, after a moment's time, the frog brought up a second mass of mud, near the first. This was repeated many times, the result being the gradual erection of a circular wall. From time to time the builder's head and front part of body appeared suddenly with a load of mud on some opposite point. But what astonished us in the highest degree was the manner in which it used its hands for smoothing the inside of the mud wall, as would a mason with his trowel. And by examining the hands of *Hyla faber* it will readily be understood that they must act as excellent trowels, the terminal phalanges supporting very large expansions. This careful smoothening could be better observed as the wall got higher, until it reached about four inches, and the Tree-Frog was then obliged to get out of the water. The parapet of the wall receives the same careful smoothening, but the outside is neglected. The levelling of the bottom is obtained by the action of the lower surface (belly and throat principally) together with that of the hands. We can well compare the aspect of the pool to the crater of an extinct volcano or a large porringer filled with water, measuring nearly a foot in diameter and generally of a very regular circular form.

Now we have to record another observation, made with the most positive certainty, viz., that the male frog is present during the erection of the nest or pool, in a perfectly passive manner however, that is sitting on the back of the female. However, his erotic ardour is by no means such a frantic one as I have often witnessed in certain European frogs and toads, for, if frightened, the male jumps off and dives down, though not very far. Some time after you will see him emerge again at a few feet distance, and, if all danger seems past, he will suddenly climb up the wall of his home and resume his former position. The building operations are performed in the most absolute silence. The croakers around are all males clamouring for a mate.

These Tree-Frogs work exclusively during the night; in the daytime no sign of Batrachian life can be detected about the pools.

Pool no. 3 was finished in two nights (18th and 19th February). On the 20th, in the morning, it was filled with eggs. But on other pools we observed that the eggs sometimes appear only 4 or 5 days after their completion. From 4 to 5 days is necessary for the young tadpoles to leave the eggs; various circumstances, especially the weather, cause sensible differences. Heavy rainfall may destroy the pools, rapidly reducing the height of the walls and thus prematurely releasing part of the tadpoles. But a good number of them will be left on the bottom, and will abandon their nursery only in due time. The parents keep during the day in the neighbourhood of their pools, but are very difficult to discover; sometimes we detected the female hidden at the bottom of the pool.

Eggs and tadpoles were carefully studied, observed, and compared, in order to get a positive and sure basis for an accurate determination and to avoid any chance of confusion. My cousin undertook to rear simultaneously tadpoles in unlimited freedom and others kept in tubs, some specimens being put into alcohol from time to time, carefully noting the results. Details about dimensions, coloration, and changes with growth, I reserve for a future note. I may, however, anticipate this by stating that the tadpoles of *Hyla faber*, though rapidly attaining a large size, as may be expected of one of the largest species of Tree-Frogs, preserve for a long time the larval tail, which disappears only when the young frog has reached nearly 3 cm. in length. A young "ferreiro" of these dimensions, which had just lost its tail, was sent by me some months ago to Mr. Boulenger for the British Museum collection.

Having seen several hundreds of adult individuals alive, I may be allowed to say a few words as to the external features of *Hyla faber*. To define what is in fact to be considered as the normal coloration is by no means an easy task, as all the Brazilian Tree-Frogs I have yet observed modify their colours wonderfully according to the surroundings and especially the different degrees of light. Put one of these *Hyla faber* near the window, in a well-illuminated place, it will rapidly turn pale; examine the same individual at night, and the longitudinal median stripe of the back, as well as the transverse dark bars of the hind legs, are very distinct.

In the literature at my disposal I can find only one figure of *Hyla faber*—that given by Prince Maximilian[1], underside and lateral view. The figure is tolerable, and easily recognizable. But concerning the underside I must remark that *Hyla faber* exhibits a very beautiful orange tinge, and not the whitish colour (due to spirit preservation) shown in the figure.

Hyla faber is easily kept alive for a considerable time, even without special care; it is a tolerably hardy Tree-Frog, and could be, I am convinced, transported quite well, alive, to England, especially during the European summer.

I feel really happy to have succeeded in clearing up the natural history of one of the most remarkable forms of tailless Batrachians in South America, a Tree-Frog which will ever attract the attention and curiosity of all lovers of nature. How many times have I not been questioned as to the scientific name of this "ferreiro," both by Brazilians and foreigners; how often have they not been alluded to in the books of travellers!

I find that Hensel observed in Rio Grande do Sul pools similar to those above described, which he attributes to *Cystignathus ocellatus.* The description makes me almost sure that the pools seen by Hensel and by me had the same origin, and that the author was wrong in his supposition. Hensel was a good naturalist, but in this case I maintain most positively that, though *Cystignathus ocellatus* is very often to be found together with *Hyla faber* in the same locality and pond, the nursery-pools in the Serra dos Orgãos are constructions due to *Hyla faber.* I have all the more reason to maintain this assertion against the authority of the distinguished German naturalist, as I myself, prior to 1893, attributed the pools to *Cystignathus.* Really the error is easy to understand, as during the day the most frequent Batrachian to be seen in these localities is the last-named big and well-known frog, whilst *Hyla faber* works at the pools only during the night, keeping hidden during the day. This mistake, as I think, has been repeated by others on Hensel's authority (see Mr. Boulenger's remarks in connection with Dr. von Ihering's note on the oviposition of *Phyllomedusa*, Ann. & Mag. N. H. ser. 5, xvii. p. 464).

2. HYLA POLYTÆNIA, Cope.

Hyla rubicundula, Günther, nec Reinhardt et Lütken.

The charming little Tree-Frog, of which an excellent figure was given by Dr. Günther in 1868[2], is very frequent in the Serra dos Orgãos. At Colonia Alpina half a dozen or more can be collected on the same nocturnal excursion. The voice is an acute "gr-gr-gr . . . .," tolerably melodious, resembling somewhat the chirping of certain small birds, the wren for instance.

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[1] 'Abbildungen zur Naturgeschichte Brasiliens,' tab. 49.

[2] "First Account of Species of Tailless Batrachians added to the Collection of the British Museum," P. Z. S. 1868, pl. xl. fig. 3.

I have likewise some observations on the life-history of this Batrachian. But I shall be brief on this subject, limiting myself to essential points. *Hyla polytænia* makes no nursery-pools for its offspring. It deposits its eggs in free lumpy masses on water-plants. I have a photograph taken by my cousin in the beginning of this year, showing such masses attached to a branch of a species of *Tradescantia*, taken from the margin of the same pond as mentioned above. My cousin informs me that the tadpoles have a remarkably slow development, and supposes that the larval condition lasts a whole year.

3. HYLA GOELDII, Boulenger.

At Colonia Alpina we discovered in the water which, as is well known, is present in the central cup of certain *Bromeliaceæ* (*Bilbergia*, &c.) another pretty Tree-Frog. I could not determine it, even with the help of Mr. Boulenger's 'Catalogue' (published in 1882), though it is a very distinct and characteristic species. Alive it is of a greenish-grey colour, with a violin-shaped dark figure on the anterior half of the dorsal median line and large transverse bars on the hind legs.

The first specimen found was a female, carrying on her back a lumpy mass of about 10 large, globular, whitish eggs. This fact was sufficient to attract my attention, guessing that I was on the track of a similar case as observed formerly by Bello, Gundlach, and Bavay on the "Coqui" (*Hylodes martinicensis*) of the West Indies. The specimen was put in a large glass, fitted up rapidly to a tolerably habitable vivarium. For a few days the egg-mass remained attached to the mother's back. But suddenly it fell away and simultaneously I saw in the glass some small, nearly black-coloured frogs, all provided with the anterior and posterior legs, together with a larval tail of medium or rather small size. These young exhibited, from the first moment, a quite unexpected agility and independence, jumping about perfectly well and showing marked preference to stick to the glass walls and to the surfaces of the stones rather than to remain in the water. Part of them I put in a tube with alcohol, which I sent to Mr. Boulenger, together with the mother, while a second, larger specimen, obtained some days afterwards and found in a dry bamboo, very near the locality of the mentioned *Bromelia*, went to London, *viâ* Paris, in order to enable my friend Dr. Trouessart to study *in situ* some psoric Acarids (larvæ of a species of *Trombidium*), visible as crimson points on the abdominal side. The discovery of this second specimen was due to the strong sibilance[1] emitted every night just below our bed-room; the voice is much louder than that of *Hyla polytænia*. I had hoped to succeed in bringing up the remaining part of the young Tree-Frogs. But they died one after the other in a few days, without my being able to assign any cause for this mortality. Thus my study unfortunately soon came to an end.

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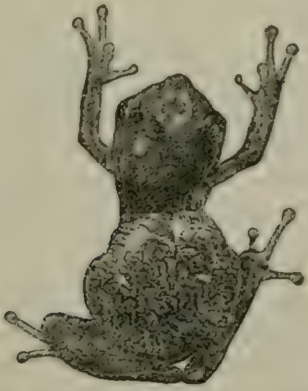
[1] In 1886 (Ann. & Mag. N. H. ser. 5, xvii. p. 462) Dr. H. von Ihering wrote about the voice of *Phyllomedusa iheringii*:—"Their moderately loud voice resembles somewhat the sound produced by running the finger-nail along a thick hair-comb."

The first author who, as I believe, noted that the Bromelia-water often contains larvæ of Brazilian Batrachians was Prince Maximilian. Thus he writes about his *Hyla luteola*:—"Er lebt auf den Gesträuchen, besonders auf den stiefen Blättern der Bromelien, wo er auch in dem daselbst zurückbleibenden Regenwasser seine Brut anbringt." But he tells us nothing about the abridged direct development. This discovery is due, I find by reference to what literature[1] is accessible to me, to Dr. Bello in Puertorico. Peters, of Berlin, states, in 1876[2], that Dr. Gundlach re-discovered the fact, having made thorough observations on the Antillean "Coqui" (*Hylodes martinicensis*). Unfortunately I have nothing to add to these statements, now already 20 years old, beyond the circumstance that not only in the Antillean region, but also in the South-American continent, there exist Batrachians which leave the egg in a highly developed condition, provided with the extremities and the other requisites for terrestrial life. I find, moreover, I cannot lay claim to the first discovery of the breeding-habits of the above mentioned *Hyla*. On looking through some old papers left by Dr. Fritz Müller, I recently came across some notes and a photograph, which evidently refer to the same facts. Mr. Boulenger, to whom I submitted these documents, informs me that Dr. Fritz Müller's observations, communicated by him to Darwin, were published in 1879 in the journal 'Nature'

Fig. 2.



Hyla goeldi, with egg-mass on back. ('Nature,' xix. p. 463.)

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[1] See, on this subject especially, F. K. Knauer, 'Naturgeschichte der Lurche' (Wien, 1878), p. 83 *seq.*; and Mr. Boulenger, Ann. & Mag. N. H. ser. 5, xvii. p. 464.

[2] "Ueber eine von Krug und Gundlach auf der Insel Puertorico gemachte Sammlung von Amphibien, sowie über die Entwicklung eines Batrachiers, *Hylodes martinicensis*." Monatsb. d. k. Akad. Wissensch. Berlin, November 1876. (Quoted from Knauer.)

(vol. xix. p. 462), with a figure, which is now reproduced, by kind permission of the proprietors, together with the original note:—"If I remember well I have already told you of the curious fauna which is to be met with between the leaves of our *Bromeliæ*. Lately I found in a large *Bromelia* a little frog (*Hylodes?*) bearing its eggs on the back. The eggs were very large, so that nine of them covered the whole back, from the shoulders to the hind end, as you will see in the photograph (see p. 95) accompanying this letter (the little animal was so restless that only after many fruitless trials a tolerable photograph could be obtained). The tadpoles, on emerging from the eggs, were already provided with hind-legs; and one of them lived with me about a fortnight, when the fore-legs also had made their appearance. During this time I saw no external branchiæ, nor did I find any opening which might lead to internal branchiæ."

Mr. Boulenger, to whom I am indebted for continued help and advice in my attempts to work at Brazilian herpetology, took great interest in the present Tree-Frog, which he has kindly named after me, and described in the 'Proceedings' of this Society for 1894 (p. 645).

4. Hyla nebulosa, Spix.

Hyla luteola, Günther et Burmeister.

In the sheaths of old and decaying leaves of banana-trees (*Musa*) we have often found another Tree-Frog, so often that we have designated it as the Banana-Frog. It is generally brownish above, turning to yellowish in the daylight; below yellow, with vertical bluish bars on the sides of the thighs. I identify it, not without some hesitation, with *H. nebulosa*, Spix, as defined by Mr. Boulenger, p. 397 of his 'Catalogue.'

I have a few words to say on this Tree-Frog, as it presents a fourth mode of oviposition. It glues its lumps of eggs on the edges and on the inside of withered banana-leaves, where, even during the hot hours of the day, sufficient coolness and moisture are preserved.

These lumps are enveloped in a frothy, whitish substance, comparable to the scum formed by certain *Cicadidæ*, so frequently met with in European meadows. Sometimes the tailed larvæ are seen wriggling in this frothy mass. *If they be put into fresh water all will die in a few hours.* We have many times repeated this experiment, and are convinced that superabundance of water is directly noxious to them. There can be no other explanation but that a quantity of water, covering entirely the lump, intercepts the respiration.

Herpetologists will find a striking resemblance between my observations on this "Banana-Frog" and those made by Dr. H. von Ihering on the oviposition of *Phyllomedusa iheringi*[1], as described

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[1] I have found several specimens of a species, not yet identified with certitude, of *Phyllomedusa* in the Serra dos Orgãos, but I have not been able to observe the life-history of this interesting and magnificent Tree-Frog.

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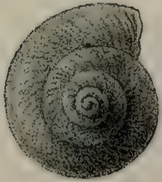
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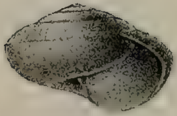
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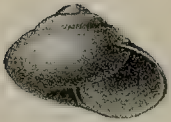
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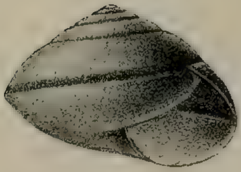
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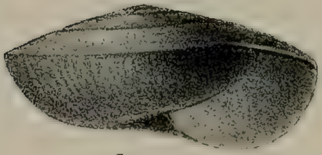
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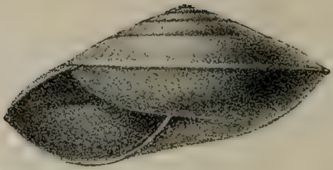
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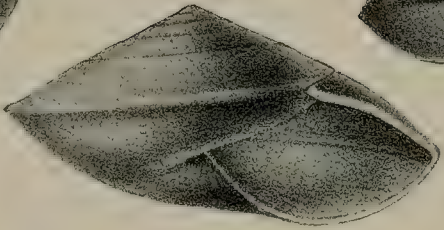
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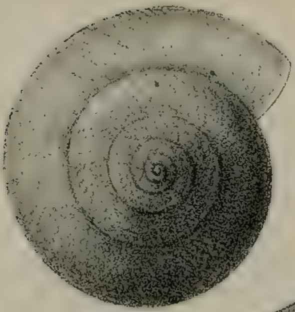
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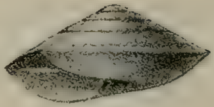
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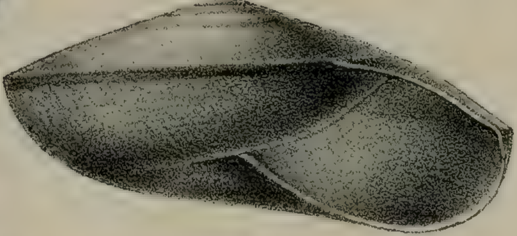
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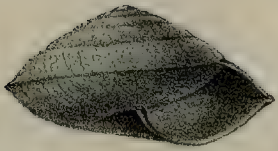
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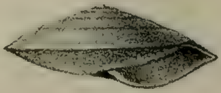
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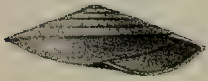
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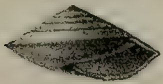
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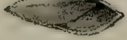
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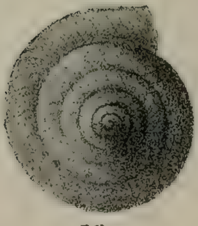
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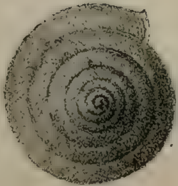
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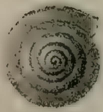
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LAND SHELLS FROM BORNEO, PALAWAN, ETC.

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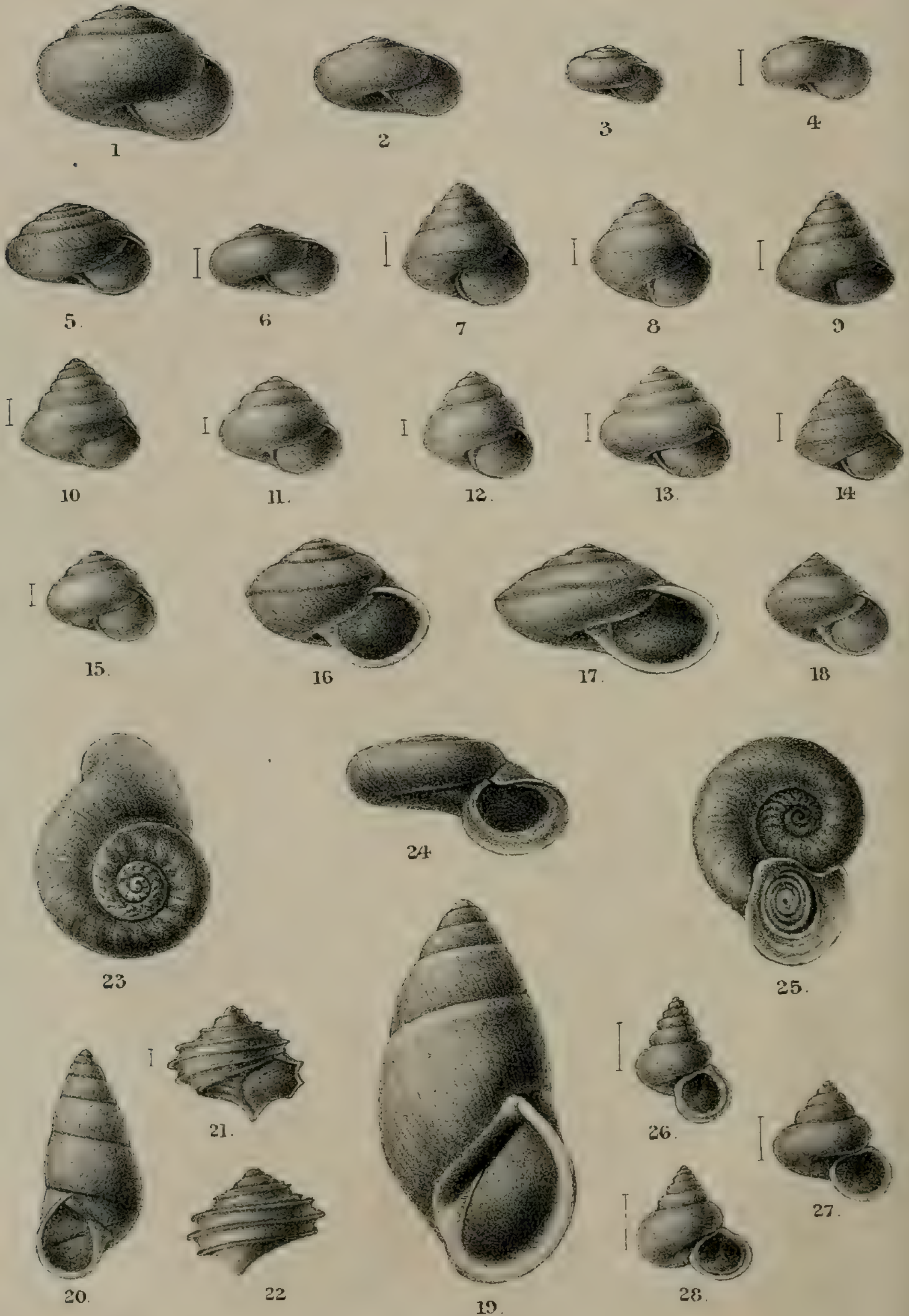

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LAND SHELLS FROM BORNEO, PALAWAN, ETC.

BRITISH MUSEUM
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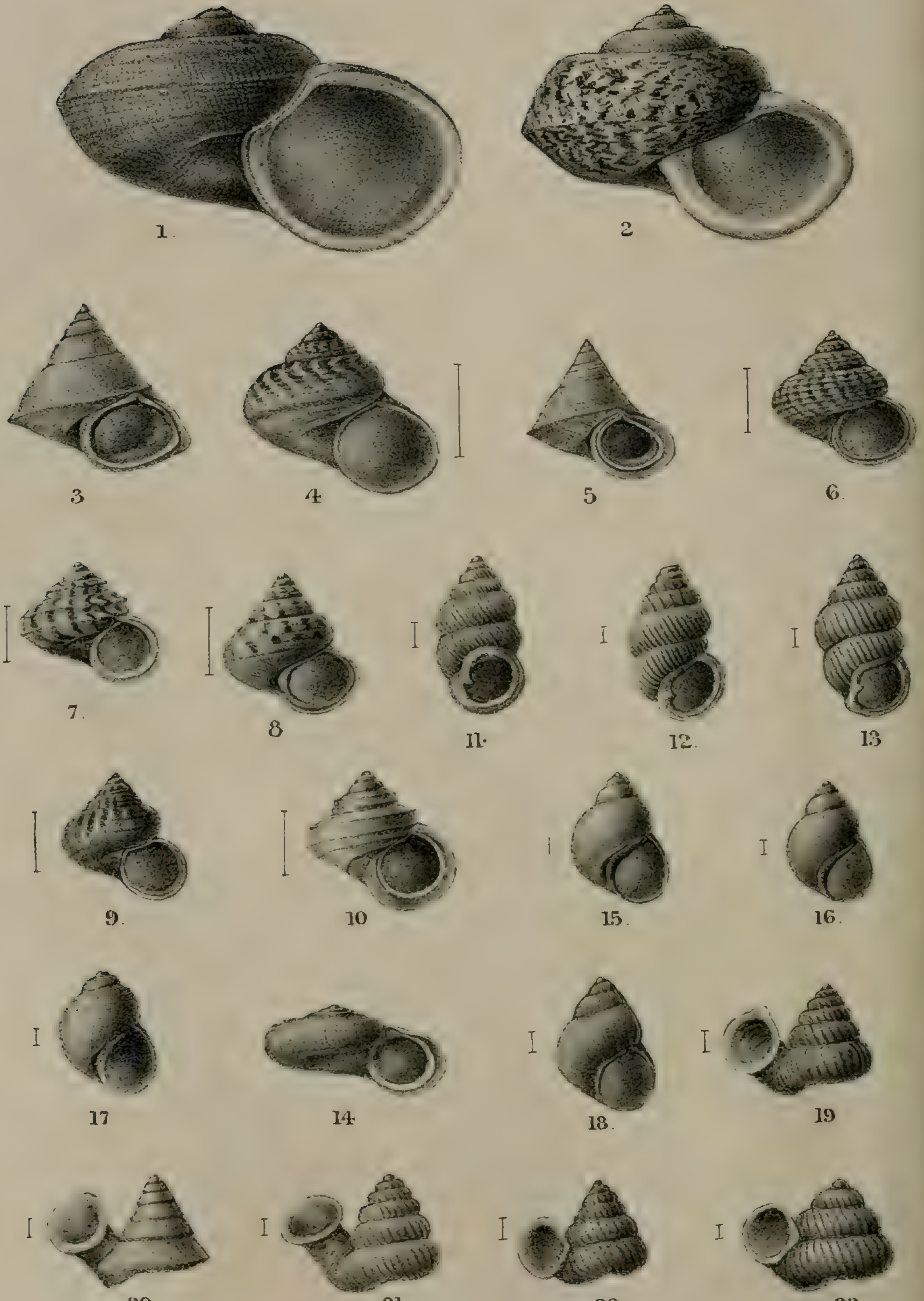
NATURAL HISTORY

P. Z. S. 1895. Pl. IV



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LAND SHELLS FROM BORNEO, PALAWAN, ETC.

in 1886. They agree very closely. The difference is that in the case of *Phyllomedusa* the egg-masses are glued between leaves overhanging water, while in the case of *Hyla nebulosa* they are in the sheaths of old banana-leaves; this is of course of secondary importance.

But this agreement, together with my experiments above quoted, makes me doubtful whether, even in the case of *Phyllomedusa*, the egg-masses are suspended from leaves in order to facilitate direct dropping of the larvæ into the water below. Naturally that is the first idea which occurs to the observer. But how, then, to explain the result of the experiment made with *Hyla nebulosa*? Is it not rather the *coolness* and moisture which the vicinity to water afford that are needed by the egg-masses than actual resort of the larvæ to water? Does not the pronounced dislike of the young *Hyla nebulosa* to remain in that element speak in favour of my supposition?

2. On a Collection of Land-Shells from Sarawak, British North Borneo, Palawan, and other neighbouring Islands. By Edgar A. Smith.

[Received January 9, 1895.]

(Plates II.–IV.)

The species mentioned in this report form part of collections received principally from Mr. A. Everett during the last two years. As many as fifty out of the eighty-three enumerated appear to be undescribed, and form a very interesting addition to the known faunæ of their respective localities. The majority were collected by Mr. Everett in various parts of Sarawak and British North Borneo, the others being obtained in some of the small islands off the coast and in the large island of Palawan.

Up to the present time nearly two hundred species of land-shells have been described from Borneo, and forty additional species are characterized in the present paper. They are nearly all from different districts in Sarawak and the northern parts of the island, only a few having been collected by Mr. Carl Bock in the south-east. When the rest of the island is explored it is probable that a very rich fauna will be discovered. The types of all the new species have been presented to the British Museum by Mr. Everett.

In the most recent list of the fauna of Palawan[1] only thirty different species were enumerated. In a subsequent paper by the present writer[2] six additional species were quoted, and twelve others are now added to the list, making a total of forty-eight species known from the island. I believe that all the eighteen species collected by Mr. Everett were from the southern part of the island, and those quoted by Dohrn[1] from the central portion near Puerto Princesa. There still remain considerable unexplored regions, so that the discovery of many new and interesting forms will doubtless be made by future collectors.

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[1] Rev. A. H. Cooke, Proc. Zool. Soc. 1892, pp. 462–463.

[2] Ann. Mag. Nat. Hist. 1893, vol. xi. pp. 347–353.

To explain at a glance the distribution of the various species which constitute the Palawan fauna, the following tabular list is appended. Only those species marked with an asterisk have been seen by the writer from Palawan, the others being quoted on the authority of Dohrn. A study of the new forms discovered by Mr. Everett does not appear to affect Mr. Cooke's comment upon the relationship of this island-fauna, namely, that "Palawan affords a link between the Philippines and the Indo-Malay islands, without being very markedly allied with either group."

Names of the Species.	Borneo.	Balabac or Banguey Is.	Palawan.	Philippines.	Other Localities.
*Hemiplecta densa, *Ad. & Rve.*	*	...	*	* ?	Labuan.
* ,, egeria, *Smith*	...	...	*		
Hemitrichia plateni, *Dohrn*	...	...	*		
Euplecta cebuensis, *Mlldff.*	...	...	*	*	
,, boholensis, *Pfr.*	...	...	*	*	
*Macrochlamys pseustes, *Smith*	...	...	*		
Lamprocystis goniogyra, *Mlldff.*	...	...	*	*	
,, succinea, *Pfr.*	...	...	*	*	
* ,, myops, *Dohrn & Semp.*	...	*	*	*	Sulu Is.
* ,, St. Johni, *G.-Aust.*	*	...	*		
*Sitala accepta, *Smith*	*	...	*		
* ,, infantilis, *Smith*	...	...	*		
* ,, baritensis, *Smith*	*	...	*		
Trochonanina conicoides, *Mtclfe.*	*	...	*		
* ,, paraguensis, *Smith*	...	*	*		
Trochomorpha loocensis, *Hid.*	...	...	*	*	
* ,, metcalfei, *Pfr.*	*	...	*	*	Sulu Is.
,, splendens, *Semp.*	...	...	*	*	
*Helix (Hadra) trailli, *Pfr.*	...	...	*		
* ,, (,,) monochroa, *Sow.*	...	*	*	...	Busuanga.
* ,, (Chloritis) euphrosyne, *Smith*	...	...	*		
,, (Eulotella) inquieta, *Dohrn.*	...	...	*		
,, (,,) fodiens, *Pfr.*	...	...	*	*	
*Amphidromus entobaptus, *Dohrn.*	...	*	*		
*Cochlostyla satyrus, *Brod*	...	*	*	...	Busuanga.
Cyclophorus acutimarginatus, *Sow.*	...	...	*	*	
,, plateni, *Dohrn*	...	...	*		
,, quadrasi, *Hid.*	...	...	*		
,, woodianus, *Lea*	...	...	*	*	
Leptopoma acuminatum, *Sow.*	...	...	*	*	
,, atricapillum, *Sow.*	...	...	*	*	
,, distinguendum, *Dohrn*	...	...	*	*	

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[1] Nachrichtsbl. deutsch. mal. Gesell. 1889, pp. 53–63.

Names of the Species.	Borneo.	Balabac or Banguey Is.	Palawan.	Philippines.	Other Localities.
Leptopoma insigne, *Sow.*	...	...	*	*	
„ luteostoma, *Sow.*	...	...	*	*	
„ superbum, *Dohrn*	...	...	*		
* „ vitreum, *Lesson*	*	*	*	*	Molucca and Sulu Is., &c.
* „ palawanensis, *Smith.*	...	...	*		
*Lagochilus simile, *Smith*	...	*	*		
*Cyclotus euzonus, *Dohrn*	...	...	*		
„ sordidus, *Pfr.*	...	...	*	...	China and Cochin China.
* „ palawanicus, *Smith*	...	...	*		
* „ pusillus, *Sow.*	...	...	*	*	
*Opisthoporus quadrasi, *Hid.*	...	*	*		
*Pupina hosei, *G.-Aust.*	*	*	*		
*Diplommatina concolor, *Quad. & Mlldff.*	...	...	*	*	
* „ rubicunda, *Mrtns.*	*	...	*	...	Natuna Is.
*Helicina usukanensis, *G.-Aust.*	...	*	*	...	Sulu Is., Mengalun, Usukan, Mantangak Is.
* „ martensi, *Issel*	*	...	*	...	Labuan, Sulu Is.

BALABAC.

Including the new species and others described or mentioned in the following pages, the total number of Land-Shells occurring in Balabac amounts to twenty-one, as follows:—

Names of the Species.	Other Localities.
Lamprocystis goniogyra, *Mlldff.*	Philippines.
„ myops, *Dohrn & Semp.*	Banguey, Palawan, Philippines, Sulu.
„ succinea, *Pfr.*	Philippines.
„ balabacensis, *Smith.*	
Trochonanina labuanensis, *Pfr.*	Borneo.
„ paraguensis, *Smith.*	
Helix (Hadra) monochroa, *Sowerby*	Palawan, Busuanga.
Corasia zamboangæ, *Hom. & Jac.*	
Cochlostyla satyrus, *Brod.*	Banguey, Palawan, Busuanga.
Amphidromus quadrasi, *Hid.*	Candaramanes or Caramandanes Is.
„ entobaptus, *Dohrn*	Palawan.
Cyclophorus triliratus, *Pfr.*	Borneo.
Opisthoporus quadrasi, *Crosse*	Palawan.
Leptopoma insigne, *Sow.*	Mindoro.
„ maculatum, *Lea*	Luzon.
„ vitreum, *Lesson*	Borneo, Palawan, Philippines, Molucca, and Sulu Is., &c.
Lagochilus similis, *Smith*	Palawan.
„ balabacensis, *Smith.*	
Diplommatina balabacensis, *Smith.*	
„ recta, *Smith*	Borneo.
Pupina hosei, *G.-Aust.*	Borneo, Palawan.

It will be seen from these tables that eight of the twenty-one species also occur in Palawan to the north, whereas only five extend into Borneo, and two of the five are likewise found in Palawan.

The relationship of the fauna may, on the whole, be considered to preponderate in favour of that of the Philippines rather than of that of Borneo.

The genera *Diplommatina* and *Pupina* are now quoted for the first time from Balabac. Both occur in Borneo and Palawan.

BANGUEY ISLAND.

Cochlostyla satyrus, Broderip, and *Hemiplecta obliquata*, Reeve, are, I believe, the only species yet recorded from this little island, situated between Borneo and the island of Balabac.

Examples of the following eight species were collected by Mr. Everett:—

1. *Everettia bangueyensis*, Smith. Peculiar.
2. ,, *subconsul*, Smith. Also N. Borneo and Mengalun I.
3. *Trochonanina alexis*, Smith. Peculiar.
4. *Helix* (*Chloritis*) *tomentosa*, var., Pfr. Also Borneo and Karamon I.
5. *Lagochilus bangueyensis*, Smith. Peculiar.
6. *Diplommatina baritensis*, Smith. Also Borneo.
7. *Georissa bangueyensis*, Smith. Peculiar.
8. *Helicina usukanensis*, G.-Aust. Mengalun, Usukan, Mantangák, Palawan, Sibutu, and Bilaton Is.

Enumeration and Description of the Species.

1. XESTA THEMIS. (Plate II. figs. 1, 2.)

Testa anguste perforata, depresse conoidea, suborbicularis, fusca, subpellucida, supra haud nitida, inferne nitens, ad peripheriam angulata, lineis incrementi arcuatis sculpti; spira brevis, ad apicem obtusa; anfractus 5–6, leviter convexi, ultimus infra angulum tenuissime spiraliter striatus; apertura obliqua, angulato-lunata; peristoma tenue, margine columellari ad insertionem paulo incrassato, brevissime expanso et reflexo.

Diam. maj. 19 *millim.*, *min.* 17, *alt.* 11.

Hab. Upper Padas, British North Borneo.

A narrowly perforated species, of a rich brown colour, a trifle paler around the perforation, with a dull upper surface, and very glossy below. It may possibly attain larger dimensions than those given above.

2. XESTA PADASENSIS. (Plate II. fig. 3.)

Testa angustissime perforata, subglobose conica, tenuissima, pellucida, pallide virenti-cornea, polita; spira breviter conica, ad apicem obtusa; anfractus 5, convexiusculi, infra suturam anguste et concave marginati, ultimus subglobosus, in medio *rotundatus, haud descendens ; apertura oblique lunata ; peristoma tenue, margine columellari superne breviter et anguste reflexo.*

Diam. maj. 18 *millim., min.* 16, *alt.* 12.

Hab. Upper Padas, British North Borneo.

A transparent, glossy, narrowly perforated shell, without colour-markings, and with only very faint lines of growth, and here and there very feeble indications of spiral striation. A dark line, occasioned by stains from the animal and which can be washed away, frequently accompanies the suture.

3. XESTA THISBE. (Plate II. fig. 4.)

Testa subglobosa, conoidea, perforata, ad peripheriam subangulata, rufo-cornea, zona angusta pallida, supra rufo-fusco marginata circa medium cincta, polita ; spira convexe conica, ad apicem mediocriter acuta ; anfractus 6, *convexiusculi, striis incrementi tenuissimis sculpti, ultimus supra et infra medium subæqualiter convexus, ad peripheriam obtuse angulatus ; apertura obliqua, irregulariter lunata ; peristoma tenuissimum, margine columellari supra umbilicum breviter dilatato, reflexo, purpureo.*

Diam. maj. 26 *millim., min.* 23, *alt.* 18.

Hab. Mount Rabong, in the south-western part of Sarawak.

Differing from *X. de crespignii* in colour, the more angular body-whorl, and more slowly increasing spire. The periphery is marked by a pale yellow narrow zone, and the rich brown band, which is contiguous with it above, revolves up the spire a short distance. The surface is highly glossy, and, in addition to the delicate lines of growth, faint indications of very fine spiral striation are here and there traceable. In certain positions the incremental striæ beneath the suture appear more distinct than upon the rest of the surface.

4. HEMIPLECTA DENSA (Adams & Reeve), var. EVERETTI. (Plate II. fig. 8.)

In the 'Annals,' 1893, vol. xi. pp. 349, 350, I mentioned the occurrence at Palawan of a very acutely keeled variety of this species. It most nearly resembles that form which is recognized as var. *schumacheriana*. It is, however, a trifle larger and flatter above, the peripheral keel in consequence appearing somewhat more acute. Additional specimens brought by Mr. Everett appear to make it advisable to designate it with a varietal name. I would therefore suggest that it be known as var. *everetti*. The largest example from the south-eastern part of the island is 58 millim. in diameter.

5. HEMIPLECTA PRÆCULTA. (Plate II. fig. 7.)

Testa anguste umbilicata, depresse conica, ad peripheriam acute carinata, mediocriter tenuis, subpellucida, cornea, epidermide pallide olivacea induta, infra suturam et peripheriam pallide vel saturate rufo-nigro marginata ; spira breviter conica ; anfractus 5–6, *celeriter accrescentes, superne vix convexiusculi, inferne*

leviter concavi, striis obliquis irregularibus tenuibus lineisque incrementi oblique curvatis sculpti, ultimus magnus, supra et infra carinam compressus, infra mediocriter convexus, oblique, concentrice, tenuiter sed corrugato-striatus; apertura obliqua, angulato-lunata; peristoma mediocriter validum, intus anguste incrassatum, ad insertionem supra umbilicum breviter expansum, fuscescens.

Diam. maj. 48 *millim., min.* 39, *alt.* 25.

Hab. Meri, Sarawak (*C. Hose*).

A single specimen was collected at the above locality by Mr. Hose, but a finer example, which may be regarded as the type, was presented to the Museum a year or two ago by Dr. H. Woodward. This fine species does not resemble any of the other known Bornean forms, and is remarkable for the conical spire, the acutely angled body-whorl, and the rapid increase of the volutions. The fine oblique wrinkly striation is also a characteristic feature. It is placed temporarily in *Hemiplecta*, for when the soft parts are known it may prove to be a dextral form of *Dyakia*.

6. HEMIPLECTA EGERIA. (Plate II. figs. 5, 6.)

Testa depressa, orbicularis, carinata, anguste umbilicata, fusca, concolor, supra haud nitida, infra nitens; spira depresse conoidalis, ad apicem obtusa; anfractus 6, *subplani, lente regulariter crescentes, lineis incrementi tenuibus striati, et supra minutissime corrugati vel subgranulati, ultimus subacute carinatus, infra carinam convexiusculus, nitidissimus, lineis spiralibus microscopicis sculptus; apertura angulato-lunata, obliqua; peristoma tenue, margine columellari obliquissimo, subarcuato, ad insertionem supra umbilicum breviter dilatato et reflexo, sublivido.*

Diam. maj. 35 *millim., min.* 31, *alt.* 16.

Hab. South-west Palawan.

The upper surface of this species is of a dull appearance, resulting from the minute granulation or wrinkling. On the contrary, the underside is very highly polished. It differs from *H. densa*, var. *everetti*, not only in sculpture, but in the less rapid increase of the whorls, the flatter spire, and narrower umbilicus. The excessively fine concentric striæ upon the lower surface are particularly noticeable within the aperture, where the surface of the whorl is dulled by a filmy deposit. It may be a dextral form of *Dyakia*.

7. HEMIPLECTA RABONGENSIS. (Plate II. fig. 9.)

Testa depresse conica, anguste perforata, tenuis, cornea, apicem versus fuscescens, supra haud nitida, infra sericata, ad peripheriam acute carinata; spira breviter conica, ad apicem obtusa; anfractus 7, *vix convexiusculi, lente accrescentes, undique minute granulati, lineisque incrementi obliquis sculpti, supra suturam anguste marginati, ultimus infra medium convexiusculus, minutissime corrugatus vel subgranulatus; apertura*

angulato-lunata, obliqua; peristoma tenuissimum, margine columellari supra umbilicum breviter reflexo.

Diam. maj. 29 *millim., min.* 26·5, *alt.* 16.

Hab. Mount Rabong in the south-western part of Sarawak.

This species, which may possibly be a dextral *Dyakia*, is quite distinct from *H. densa* or *H. egeria*. It has a more raised spire than the latter, is more strongly sculptured both above and beneath, and is less glossy upon the under surface. *H. densa* is more widely umbilicated, is differently sculptured, and has much more rapidly enlarging whorls, which also, in shells of the same dimensions, are fewer in number.

8. DYAKIA LINDSTEDTI (Pfeiffer). (Plate II. fig. 10.)

Helix lindstedti, Pfr. Proc. Zool. Soc. 1856, p. 387; Mon. Hel. vol. iv. p. 31.

Hab. Malacca (*Pfr.*); Penrisen Mountain, Sarawak, up to 3500 feet (*A. Everett*).

Two varieties were collected at the above locality by Mr. Everett. Both are represented by dextral and sinistral specimens, the latter appearing to be the more common form. The rate of growth in all of these specimens is imperceptibly slower than in the type of the species, so that the last whorl is very slightly narrower. One of the varieties is of the same uniform pale greenish horn colour as the type; the other (var. *castanea*) of a rich brown tint, excepting the keel and suture, which are yellowish. This may be *Nanina janus* (Chemn.), as identified by Dr. E. von Martens (Preuss. Exped. Ost-Asien, Zool. vol. ii. p. 226, pl. xi. fig. 4). The sculpture is precisely similar in all.

This species approaches very closely to *D. regalis* in form and sculpture, but it does not exhibit the plications at the upper part of the spire which are characteristic of that species. *D. regalis*, however, which is variable in colour, is usually rather smaller; the basal portion of the latter around the umbilicus is of an opaque creamy tint. A somewhat similar pale zone exists in the type of *D. lindstedti* and is also faintly indicated in some of the Penrisen shells. Probably the two species pass imperceptibly one into the other.

The shell figured is the type specimen described by Pfeiffer from Malacca.

9. DYAKIA BUSANENSIS, Godwin-Austen, var.

Dyakia busanensis, G.-A. Proc. Zool. Soc. 1891, p. 31, pl. ii. fig. 1.

Hab. Batang Lupar district, Sarawak.

The specimens from this locality differ from the typical form in being of a uniforn horny brown colour (var. *concolor*). The spire may be a trifle less conical, but as regards the number of whorls and the character of the sculpture they are practically identical. The whorls are a trifle convex and distinctly impressed above the suture. Although not mentioned by Godwin-Austen, there are microscopic spiral or concentric striæ on the base, and, near the keel, they are quite evident, even under an ordinary lens. *Nanina sarawakana*, Dohrn, appears to be very near this species.

10. DYAKIA SUBDEBILIS. (Plate II. fig. 11.)

Testa sinistrorsa, tenuis, anguste perforata, pallide fuscescens, ad carinam medianam et suturam linea pallida cincta; spira depresse conica, ad apicem obtusa; anfractus 6, *lente accrescentes, planiusculi, supra suturam impressi, lineis incrementi oblique arcuatis sculpti, minute granulati, granulis minutissimis in seriebus spiralibus plus minus regularibus dispositis; anfr. ultimus ad peripheriam acutissime carinatus (carina utrinque compressa), infra convexiusculus, nitidior quam supra, similariter insculptus; apertura angusta, obliqua; peristoma tenuissimum, margine columellari ad insertionem paulum reflexo.*

Diam. maj. 23 *millim., min.* 20, *alt.* 11.

Hab. Sarawak (*C. Hose*).

The precise locality of the single specimen presented to the British Museum by Mr. Hose is unknown, but it may possibly be Baram. With the exception of *D. moluensis* of Godwin-Austen, this species is smoother than any of the Bornean forms of *Dyakia*, and on this account is not likely to be mistaken for the young of some of the larger species. It is coloured like the "*first variety*" of the preceding species, but is a trifle paler; it is, however, differently sculptured and the whorls enlarge less rapidly.

TROCHONANINA.

The present collection contains three forms of this genus which cannot satisfactorily be referred to any of the known species from Palawan, Balabac, Borneo, Labuan, Natuna, Sulu, and Philippine Islands. They agree with *T. paraguensis*, Smith, and *T. bongaoensis*, Smith, in the thickened sinuous lower margin or lip of the aperture, and the differences consist in size, colour, and sculpture. Another species, the smallest of the whole series having the thickened basal lip, was referred by the writer to *T. conicoides* under the varietal name of *parva*. Having re-examined these specimens, together with the fresh material collected by Mr. Everett, I am now of opinion that it will be more philosophic and satisfactory to designate, by separate names, these forms, which, although bearing such a strong general resemblance to one another, are still recognizable by certain, although perhaps only slight, differences. This is one of those cases which occasionally present themselves, in which it is so difficult to come to a decision. Take the two extreme forms of the series and there is no difficulty in at once regarding them as distinct species, and it would be absurd not to do so, but when the various intermediate forms present themselves we are puzzled how to proceed,

11. TROCHONANINA PARAGUENSIS, Smith.

Trochonanina paraguensis, Smith, Ann. Mag. Nat. Hist. 1893, vol. xi. p. 349, pl. xviii. figs. 7–9.

Hab. Balabac and Palawan.

The specimens from Balabac offer no variation from those occurring at Palawan. A small variety, 13 millim. in diameter, occurring at the latter island, has the same number of whorls, but the spire a little more conical than the type.

12. TROCHONANINA ALEXIS. (Plate II. figs. 13, 14.)

Testa T. paraguensi *affinis, sed plerumque paulo major, fusca, labro incrassato roseo, anfractibus* 8, *supra peromnes partes spiraliter tenuiter striatis, ultimo angustiore, infra vix concentrice striato.*

Diam. maj. 21½ *millim., min.* 20, *alt.* 8.

Diam. maj. 18½ *millim., min.* 17, *alt.* 7½.

Hab. Banguey Island.

This species is of a uniform brown tint above and below, and the thickened lip is pale rose. The spiral sculpture on the upper surface extends over the whorls and is finer than in *T. paraguensis*. The shell also is a little more compressed, and the body-whorl is narrower, and with only feeble traces of spiral striæ beneath.

13. TROCHONANINA HERACLEA. (Plate II. fig. 12.)

Testa T. bongaoensi *affinis, sed spira magis conica, anfractibus lentius accrescentibus, ultimo latiore, lineis spiralibus et incrementi validioribus.*

Diam. 17 *millim., alt.* 8.

Hab. Mount Rabong, West Sarawak.

A trifle larger than *T. bongaoensis* (Ann. & Mag. N. H. 1894, vol. xiii. p. 52, pl. iv. figs. 2–2 *b*), but of the same brown colour and general appearance. The lip is rosy white and tortuous as in *T. bongaoensis*, but the spire is not convexly conoidal, but with rectilinear sides, the increase and width of the whorls are different, and the spiral sculpture is stronger.

14. TROCHONANINA KINA-BALUENSIS. (Plate II. figs. 15, 16.)

Testa imperforata, depressa, acute carinata, rufo-castanea, supra fortiter spiraliter striata, infra lineis incrementi modo striata; spira conica, parum elata; anfractus 7, *supremi pallidi, convexiusculi, cæteri planiusculi, supra suturam albo-marginatam leviter impressi, incrementi lineis et striis spiralibus sculpti, ultimus acutissime carinatus, infra convexiusculus, prope carinam impressus; apertura angulatim lunaris, margine basali conspicue incrassato et leviter reflexo, purpureo-rufo, ad insertionem pallido, paulo dilatato, margine superiore tenui.*

Diam. maj. 23·5 *millim., min.* 21, *alt.* 10.

Hab. Kina Balu, 3000–4000 feet (*A. Everett*).

Var. PALLIDA. *Testa typo minor, dilute fusco-cornea. Diam. maj.* 16 *millim., min.* 14, *alt.* 6.

The variety, which was collected at the same locality as the type, consists of the same number of whorls, is similarly sculptured, and has a similar aperture and peristome. With the exception of its small size and paler colour, it agrees perfectly with the typical form. The colour of the latter is a rich purplish red-chestnut above and below. The extreme edge of the keel and the suture are pale, and above and beneath the keel and above the suture a narrow dark spiral line is observable. It differs from *T. alexis* in colour, the greater width of the whorls, and the much stronger spiral sculpture.

15. TROCHONANINA WHITEHEADI. (Plate II. figs. 17, 18.)

Testa parva, T. paraguensi *similis, sed minor, carina acutiore, labio magis sinuoso.*

Diam. maj. 11½ *millim., alt.* 5.

Hab. N. Borneo (*J. Whitehead*).

This is the smallest of the known Bornean forms. It has all the general characters of *T. paraguensis*, but may be separated on account of certain slight differences, such as the sharper more compressed keel, somewhat paler colour, and more sinuous basal lip.

EVERETTIA, Godwin-Austen.

Nearly all of the species of this genus are exceedingly difficult to distinguish by their shells, and it is quite impossible to determine them from the published descriptions or even the figures. The slightest inaccuracy in outline gives to a figure quite a different appearance from the specimen delineated. It is only by comparison of the type examples that we can determine the species with any degree of certainty, and even under these favourable circumstances it is a task of no mean difficulty. With the exception of *E. hyalina* (Martens), the types of all the known species from Borneo are in the British Museum, and consequently the determination of a number of forms from that island, acquired within the last two or three years, is to a great extent facilitated. *E. bocki*, quoted by Godwin-Austen[1] as of Issel, is purely imaginary, and is not described at the reference given.

16. EVERETTIA SUBIMPERFORATA. (Plate III. fig. 1.)

Testa E. consuli *subsimilis, sed minus depressa, solidiuscula, vix perforata, nitidissima, supra et infra tenuissime spiraliter striata, lineisque incrementi obliquis infra suturam confertim plicatis sculpta ; anfractus* 6½, *convexiusculi, lente et regulariter accrescentes, ultimus rotundatus, infra in medio impressus ; apertura oblique lunata, intus opalescens ; peristoma tenuissimum, margine columellari leviter incrassato, ad insertionem breviter reflexo umbilicum fere tegente.*

Diam. maj. 26 *millim., min.* 23, *alt.* 17.

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[1] P. Z. S. 1891, p. 36.

Hab. Poch Mountain, Sarawak.

Less depressed and more solid than *E. consul* and with scarcely any umbilical perforation. The coloration is similar in both species. The figures of *E. consul* (Pfeiffer, Novit. Conch. vol. iii. pl. lxxiv. figs. 11, 12) give an admirable idea of the adult form of the species. The type originally described was not quite full-grown and consists of half a whorl less than the shell delineated.

17. EVERETTIA CONSUL (Pfeiffer).

Helix consul, Pfr. Novitates Conch. vol. iii. p. 306, pl. lxxiv. figs. 11, 12 (not 13, 14, as quoted by Martens, Godwin-Austen, and Issel); Reeve, Con. Icon. fig. 1395.

Hab. Sarawak (the type); Labuan (*Pfr. l. c.*); Sarawak (*A. Everett*).

The large specimen figured by Pfeiffer I regard as the adult form, and not as a variety. With the exception of having completed an additional half-whorl, and thus added considerably to its size, I can discover no difference between it and the type shell.

18. EVERETTIA SUBCONSUL (Smith).

Nanina subconsul, Smith, Ann. Mag. Nat. Hist. 1887, vol. xx. p. 132.

Macrochlamys subconsul, Smith, Ann. Soc. Roy. Malac. Belgique, vol. xxii. p. 217, pl. ix. figs. 4–6.

Hab. North Borneo (type); Banguey and Mengalun Islands, also Kina Balu (*Everett*).

The specimens obtained at Kina Balu exhibit a somewhat more distinct angulation upon the body-whorl than the type. Two examples from Mengalun Island are much more thickened than the type, probably being older shells, and one of them is of a rich brown colour, the other of an olivaceous yellow tint.

19. EVERETTIA JUCUNDA (Pfeiffer).

Helix jucunda, Pfr. Novitat. Conch. vol. iii. p. 307, pl. lxxiv. figs. 13, 14 (not figs. 11, 12, as quoted by Martens, Issel, and Godwin-Austen).

Hab. Labuan (type); Labuan and Tiga Island (*Everett*), Baram in Sarawak (*C. Hose*).

The figure given by Martens (Preuss. Exped. Ost-Asien, Zool. Bd. ii. pl. xii. fig. 7) appears to represent this species, although on close examination it is seen to consist of about one whorl less than the type; but perfect accuracy in a matter of this kind is not to be expected from the average artist.

20. EVERETTIA PLANIOR. (Plate III. fig. 2.)

Testa E. consuli *similis, sed minor, spira minus elata, anfractibus minus numerosis, ultimo latiore.*

Diam. maj. 19·5 *millim., min.* 17, *alt.* 10.

Hab. Niah, Sarawak.

The above dimensions are those of the largest of the eight specimens in the Museum. On comparing them with examples of *E. consul* of the same size, it is seen that they consist of half a whorl less, which gives quite a different look to the spire. This is distinctly less elevated, and the body-whorl, seen from above, appears to be rather broader. The colour is about the same in both species and the sculpture very similar, but the spiral striæ upon the base of the present species are a trifle more distinct than in *E. consul.*

21. Everettia aglaja (Pfeiffer).

Helix aglaja, Pfeiffer, Reeve, Conch. Icon. f. 1396.

Nanina (*Macrochlamys*) *aglaja*, Martens, Preuss. Exp. Ost-Asien, Zool. vol. ii. p. 242, pl. 12. fig. 13.

Hab. Sarawak (type); Barit Mountain (*Everett*).

Neither Reeve's nor Martens's figure gives a good idea of the type of this species. The subplications at the suture are the principal distinguishing feature.

22. Everettia baramensis. (Plate III. fig. 3.)

Testa E. aglajæ *similis, sed virescens, supra minus polita, lineis incrementi ad suturam haud plicatulis, anfractibus minus numerosis.*

Diam. maj. 13 *millim., min.* 11, *alt.* 6·5.

Hab. Dulit Mountain and Apoh, Baram; varieties from Barit Mountain.

The greenish tint of this species serves to separate it from the other Bornean forms of this genus. It is of the same size, presuming it to be full-grown, as *E. aglaja*, but is quite distinct on account of the difference of sculpture and the number of whorls. There are only five volutions in the present species, whereas in *E. aglaja* there are 5½–6. The upper surface has a somewhat dull silky appearance and is devoid of the conspicuous plications below the suture which are so characteristic of *E. aglaja.*

The specimens from Barit Mountain differ from the type and belong to two varieties—the one differing only in having more conspicuous lines of growth upon the upper surface, the other in colour: instead of the greenish tint of the type, they are of a brown colour excepting a yellowish central portion of the base. This form has sculpture equally fine as the type.

23. Everettia bangueyensis. (Plate III. fig. 4.)

Testa parva, depressa, orbicularis, anguste perforata, tenuis, fusco-cornea, subpellucida, nitens; spira parum elata; anfractus 5½, *convexi, lente accrescentes, sutura profunda sejuncti, ultimus ad peripheriam rotundatus, infra paulo pallidior; apertura oblique lunata, angusta; perist. tenue, margine columellari superne anguste reflexo.*

Diam. maj. 9 *millim., min.* 8, *alt.* 4¾.

Hab. Banguey Island, north of Borneo.

This species somewhat resembles *E. aglaja*, but is somewhat smaller, has a flatter spire, a deeper suture, and, for its size, more numerous whorls.

24. EVERETTIA THALIA. (Plate III. fig. 5.)

Testa depresse conoidea, suborbicularis, sordide pellucida, epidermide olivacea induta, imperforata ; spira brevis, convexe conoidea, ad apicem obtusa ; anfractus 6–7, *convexiusculi, lente accrescentes, superne fortissime arcuatim et oblique striati, haud nitidi, ultimus ad peripheriam subangulatus* (*angulo aperturam versus sensim evanescente*), *infra convexiusculus, aliquanto lævigatus, lineis incrementi tenuibus striatus, in medio paulo impressus ; apertura oblique lunata ; peristoma tenue, margine columellari superne leviter incrassato, reflexo, appresso.*

Diam. maj. 19 *millim., min.* 17½, *alt.* 13.

Hab. Mount Rabong.

This species is at once distinguishable by the strong curved oblique raised lines of growth upon the upper surface, and the imperforate impressed base which is somewhat glossy, whereas the spire is more or less dull. *Aglaia*, the name of one of the three Graces and daughter of Jupiter and Antonoë, having been associated by Pfeiffer with a species of this genus, it seemed suitable to make use of her sister's name *Thalia* in connection with an allied form.

25. EVERETTIA CUTTERI (H. Adams).

Macrochlamys cutteri, H. Ad. Proc. Zool. Soc. 1870, p. 794, pl. xlviii. fig. 21.

Hab. Busau (*H. Adams & Everett*).

The locality Busau is printed erroneously Busan by H. Adams and Godwin-Austen, P. Z. S. 1889, pp. 334–355, 1891, pp. 37–46, and therefore for *busanensis*, the term applied to several species, *busauensis* should be substituted.

26. LAMPROCYSTIS MYOPS (Dohrn & Semper).

Lam. chlororhaphe, Smith, Ann. & Mag. 1893, vol. xi. p. 348, pl. xviii. figs. 4–6.

Hab. Tiga Island, near Labuan.

This species appears to be widely distributed, having been recorded from Mindanao, Sulu Islands, Palawan, and Balabac. The specimens described from Palawan as *Lamprocystis chlororhaphe* undoubtedly belong to this species.

27. LAMPROCYSTIS BALABACENSIS. (Plate III. fig. 6.)

Testa depressa, orbicularis, anguste perforata, polita, cornea, subpellucida ; spira vix prominula, ad apicem obtusa ; anfractus 4½, *convexiusculi, lente accrescentes, læves, infra suturam tenuiter plicato-striati, ultimus ad peripheriam rotundatus ; apertura oblique lunata ; peristoma tenue, margine columellari superne breviter dilatato, reflexo, et peculiariter sinuato, porca parva in umbilico instructo.*

Diam. 7 *millim., alt.* 4.

Hab. Balabac.

The perforation is very small and partly hidden by the reflexed columellar margin, which is peculiarly produced and sinuated at this part. It is more depressed than *L. myops,* the whorls are more convex and the suture deeper.

28. Lamprocystis st. johni (Godwin-Austen).

Microcystina st. johni, Godwin-Austen, Proc. Zool. Soc. 1891, p. 38, pl. iv. figs. 3, 3 *a*.

Hab. Busau Hills and Palawan.

The specimens from Palawan are a little darker in tint than the type from Busau, but the intensity of the colour varies considerably according to the ground-colour upon which the specimens rest.

29. Sitala rumbangensis. (Plate III. fig. 7.)

Testa vix perforata, conica, fusco-cornea, nitida, ad peripheriam filo-carinata, lineis incrementi levibus striata, inferne striis concentricis tenuissimis sculpta; spira obtuse conoidalis; anfractus 6, *convexi, lentea ccrescentes, sutura carina saturatiore marginata sejuncti; apertura parva, lunata; peristoma tenue, margine columellari fortiter incrassato, leviter reflexo.*

Diam. maj. 4·5 *millim., min.* 4, *alt.* 4·5.

Hab. Rumbang, Sarawak, and Mount Rabong.

Var. *Testa typo paulo angustior, anfractibus* 6½ *striisque basalibus minus conspicuis. Diam. maj.* 3·3 *millim., min.* 3·2, *alt.* 4.

Hab. Mulu Mountain, N. Borneo.

The superior height in proportion to the diameter gives the variety a more conoidal appearance than the type. In all other respects they are practically similar.

It is distinguishable from *S. angulata*, Issel, by the absence of spiral striæ above, its more glossy surface, the more distinct thread-like keel, and the more thickened columella.

30. Sitala demissa. (Plate III. fig. 8.)

Testa tenuissima, pellucida, cornea, angustissime perforata, turbinata; anfractus 5, *convexiusculi, spiraliter minute striati, lineisque incrementi perobliquis tenuissimis sculpti, ultimus paulo inflatus, ad peripheriam carina filiformi cinctus, supra et infra carinam æqualiter convexus; apertura oblique lunata; peristoma tenue; columella ad insertionem paulum incrassata et reflexa.*

Diam. maj. 3·5 *millim., alt.* 3·5.

Hab. Mulu Mountain, N. Borneo; and Busau, West Sarawak.

The more inflated body-whorl distinguishes this from the other Bornean species of *Sitala*. Both the upper and lower surfaces are finely spirally striated, the striæ on the base having a minutely wavy appearance.

31. Sitala busauensis. (Plate III. fig. 9.)

Testa anguste perforata, conica, ad peripheriam carinata, dilute fusco-cornea; anfractus 6, *convexiusculi, liris obliquis tenuissimis confertis arcuatis, sutura carinata sejuncti, ultimus infra carinam paulum convexus, nitidior, concentrice tenuiter striatus; apertura parva; columella rectiuscula, leviter incrassata et reflexa.*

Diam. maj. 3·5 *millim., alt.* 3·7.

Hab. Busau, Sarawak.

The distinguishing features of this species are the well-marked fine oblique lirations upon the upper surface and the concentric striæ of the base. In form it is very like *S. angulata*, Issel.

32. Sitala cara. (Plate III. fig. 10.)

Testa trochoidea, anguste perforata, tenuis, cornea, subpellucida, carinata; spira conica, ad apicem obtusiuscula; anfractus 6, *convexi, lineis incrementi tenuissimis obliquis sculpti, lente accrescentes, ultimus infra carinam leviter convexus, striis concentricis minutis ornatus; apertura parva, lunata, vix obliqua; peristoma tenue, margine columellari declive paulo reflexo, haud incrassato.*

Diam. maj. 3·3 *millim., alt.* 3·2.

Hab. Gomanton, N.E. Borneo.

Very like *S. angulata*, Issel, but rather higher in proportion to the width, and without spiral striæ upon the spire.

33. Sitala dulcis. (Plate III. fig. 11.)

Testa depresse turbinata, minute perforata, haud carinata, fusco-cornea, sericata, striis incrementi obliquis aliisque spiralibus confertis microscopice *cancellata; spira brevis, convexa, obtusa; anfractus* 4½, *perconvexi, sutura profunda sejuncti, ultimus ad peripheriam acute rotundatus vel vix subangulatus, inferne concentrice striatus; apertura lunata, vix obliqua; peristoma tenue, margine columellari arcuato, superne dilatato et reflexo.*

Diam. maj. 2·5 *millim., alt. vix* 2.

Hab. Gomanton, N.E. Borneo.

In comparison with the other Bornean *Sitalæ*, the present species is less conical. It is allied to *S. orchis*, Godwin-Austen, but much more finely striated.

34. Sitala accepta. (Plate III. fig. 12.)

Testa angustissime perforata, rotunde conica, ad peripheriam carinata, cornea, subpellucida, lineis spiralibus microscopicis *incrementique tenuissimis decussata; spira convexe conoidea, superne obtusa; anfractus* 5–5½, *convexi, lente accrescentes, sutura carinata profunda discreti, ultimus infra carinam gracillima paulo convexus, concentrice striatus; apertura parva, irregulariter lunata, vix obliqua; peristoma tenue, margine columellari valde incrassato subreflexo, perpendiculari cum basali angulum levem formante.*

Diam. maj. 2·5 *millim.*, *alt.* 2·25.

Hab. Gomanton, N.E. Borneo, and Palawan.

The concentric striæ on the base are visible under a simple lens, but the spiral sculpture on the upper surface is discernible only under a microscope.

35. SITALA BARITENSIS, Smith.

Sitala baritensis, Smith, Journ. Linn. Soc., Zool. 1893, vol. xxiv. p. 343, pl. xxv. fig. 3.

Hab. Barit Mountain, N. Borneo, and Palawan.

The genus *Sitala* has not previously been recorded from Palawan. The specimens from this island are precisely similar to the Bornean examples.

36. SITALA AMUSSITATA. (Plate III. fig. 13.)

Testa perforata, conica, saturate olivaceo-fusca, nitens; spira elata, convexe conoidea, ad apicem pallidior, obtusa; anfractus 6, *convexi, lente accrescentes, striis minutis paucis spiralibus hic illic sculpti, ultimus ad peripheriam rotundatus, infra medium concentrice tenuissime striatus; apertura parva, lunata; perist. tenue, margine columellari leviter incrassato, pallido, reflexo; umbilicus angustissimus, pallidus.*

Diam. maj. 4·25 *millim.*, *min.* 4, *alt.* $3\frac{1}{2}$.

Hab. Busau, West Sarawak.

A rich olive-brown glossy species, with a high spire and convex whorls.

37. SITALA INÆQUISCULPTA. (Plate III. fig. 14.)

Testa conica, angustissime perforata, fusco-cornea, supra parum nitida, infra polita; spira elata, conoidea, ad apicem paulo obtusa; anfractus 6, *convexi, lente accrescentes, sutura profunda sejuncti, liris tenuissimis spiralibus* 4–5 *et lineis incrementi obliquis arcuatis elevatis cancellati, ultimus liris spiralibus sex (infima ad peripheriam sita) cinctus, infra medium concentrice tenuissime striatus, lineis incrementi levibus sculptus; apertura parva, sublunata; peristoma tenue, margine columellari paulum incrassato, pallide livido.*

Diam. maj. $3\frac{1}{2}$ *millim.*, *min.* $3\frac{1}{4}$, *alt.* $3\frac{2}{3}$.

Hab. Mount Rabong, West Sarawak.

The upper surface being cancellated and the lower smooth and glossy, this species is readily distinguishable from the other Bornean species of the genus *Sitala*.

The oblique curved lines of growth are elevated, but closer together than the spiral threads.

38. SITALA INFANTILIS. (Plate III. fig. 15.)

Testa minuta, conico-subglobosa, angustissime perforata, cornea, pellucida, polita; spira conoidea, ad apicem obtusa; anfractus 5, *convexiusculi, lente accrescentes, infra suturam anguste marginati, læves, ultimus depresse globosus; apertura oblique lunata;*

peristoma tenue, margine columellari superne paulo incrassato, anguste dilatato et reflexo.

Diam. 3 *millim., alt.* $2\frac{1}{2}$.

Hab. Palawan.

A very small, obtusely conical shell, with a very minute umbilical perforation, with scarcely any trace of sculpture.

39. Helix (Chloritis) tomentosa, Pfeiffer.

Helix tomentosa, Pfr. Mon. Hel. vol. iv. p. 271; Reeve, Con. Icon. f. 1403.

Var. *major*, Pfr. op. cit. vol. v. p. 353.

Banded var., Godwin-Austen, Proc. Zool. Soc. 1891, p. 42.

Var. = *H.* (*Fruticicola*) *everetti*, H. Adams, Proc. Zool. Soc. 1873, p. 207, pl. xxiii. fig. 11.

Hab. Sarawak and Labuan (*Pfr.*, *Issel*, *Martens*); Karamon Island for banded var. (*G.-A.*); Busau for var. *everetti* (*Everett*); Banguey Island for var. *major* (*Everett*).

H. everetti differs only from the typical form of this species in having a supra-peripheral reddish zone. It appears to have been omitted by Kobelt, Issel, Godwin-Austen, and von Martens in their lists of Bornean Pulmonata.

Specimens of the var. *major* in Cuming's collection and a specimen from Banguey Island also have the colour-band just above the middle of the body-whorl.

40. Helix (Chloritis) kina-baluensis, Kobelt. (Plate III. fig. 16.)

Helix (*Chloritis*?) *kinibalensis*, Kobelt, in Martini u. Chemnitz, Conch.-Cab. ed. 2, p. 706, pl. cci. figs. 5, 6.

Testa anguste umbilicata, depressa, subglobosa, dilute rufescens, supra peripheriam pallidam linea rufa cincta; spira breviter conoidalis, ad apicem obtusa; anfractus 5, convexi, sutura subprofunda sejuncti, oblique striati, ultimus in medio obsolete angulatus, antice paulo descendens; apertura obliqua, late lunata, intus lilacea; peristoma albidum, tenue, anguste expansum, margine columellari reflexo.

Diam. maj. 25 *millim., min.* 21, *alt.* 17.

Hab. Kina Balu, British North Borneo.

In colour this species resembles the variety of *H. tomentosa* which has a red peripheral line. It is, however, larger, has a more elevated spire, the body-whorl has a tendency to subangulation, and the peristome is more regularly curved at the base.

41. Helix (Chloritis) euphrosyne. (Plate III. fig. 17.)

Testa late umbilicata, suborbicularis, depresse conica, tenuis, dilute fuscescens, prope sed supra peripheriam zona rufo-fusca cincta, epidermide plus minus breviter pilosa haud nitida induta; spira brevis, conoidea, ad apicem mediocriter obtusa; anfractus 5, convexiusculi, subceleriter accrescentes, lineis incrementi tenuibus striati, undique minute granulati, ultimus in medio obtuse *angulatus, antice paulo descendens; apertura late et oblique lunata, intus livido-fuscescens; peristoma tenue, pallide lilaceum, undique expansum, marginibus remotis, callo tenuissimo nitente junctis.*

Diam. maj. 30 *millim., min.* 24, *alt.* 17.

Hab. Panalingoan, south-west of Palawan.

Much larger than *H. tomentosa*, more widely umbilicated and of a different form.

42. Helix (Dorcasia) incauta. (Plate III. fig. 18.)

Testa subglobosa, tenuis, anguste umbilicata, cornea vel pallide rubescens, epidermide tenui olivacea induta, incrementi lineis striata; spira brevis, conoidea, ad apicem subacuta; anfractus 6, *leviter convexiusculi, ultimus ad peripheriam obsolete angulatus, angulo linea subpellucida picto, antice haud descendens; apertura late lunata, obliqua; peristoma subincrassatum, lilaceum, margine dextro vix reflexo, columellari dilatato et reflexo.*

Diam. maj. 16 *millim., min.* 14, *alt.* 14; *apertura* 8 *longa,* 7·5 *lata.*

Hab. Sarawak (*Bartlett*).

A single specimen was presented to the British Museum by Mr. E. Bartlett in 1893. It somewhat resembles *H. fodiens*, Pfeiffer, but is more finely striated and has a more pointed spire. In addition to the fine lines of growth, faint traces of spiral striæ are also observable.

43. Helix (Papuina?) rufofilosa, Bock.

Helix (*Geotrochus*) *rufofilosa*, Bock, Proc. Zool. Soc. 1881, p. 630, pl. lv. fig. 4.

Helix (*Satsuma*) *rufofilosa*, Pilsbry, Man. Conch. ser. 2, vol. vii. p. 84, pl. iii. fig. 55.

Hab. Meri, Sarawak (*C. Hose*); Paio, Sumatra (*Bock*).

The single example collected by Mr. Hose is exactly similar to the types of this species presented to the Museum by Mr. Bock. Is it probable that this species occurs both in Borneo and Sumatra? I am rather inclined to think that Mr. Bock has made a mistake with regard to his locality. This might easily have occurred, as he collected in both islands.

44. Helix (Plectotropis) winteriana, Pfeiffer, var. β.

Hab. Busau, West Sarawak.

The specimens from this locality agree with Pfeiffer's var. β founded on Philippine examples. They are of the same small size, have a more pronounced keel than typical Javan specimens, and the under surface exhibits more distinct concentric striation than the typical form. These striæ are even more apparent in the shells from Guimaras. Both Martens[1] and Moellendorff[2] question the identity of this variety with the present species, but until we have more conclusive evidence to the contrary it seems to me advisable to consider it as such.

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[1] Reise in Ost-Asien, ii. p. 265.

[2] Jahrbuch deutsch. mal. Gesell. 1887, p. 270.

45. AMPHIDROMUS PERVERSUS, var. (Plate III. fig. 19.)

Hab. Sadong, West Sarawak.

The two dextral specimens belong to the variety named *Bulimus atricallosus* by Gould, which was founded upon specimens collected in Tavoy, Burmah.

B. eques, Pfeiffer, also belongs to this variety. The types appear to have been bleached, either naturally or artificially.

Neither of the Sadong examples exhibit any periodic oblique black stripes.

46. AMPHIDROMUS HOSEI. (Plate III. fig. 20.)

Testa parva, rimata, sinistrorsa, elongata, conica, sub epidermide tenuissima pallide flava, linea angusta rufo-purpurea circa anf. ultimi medium et supra suturam cincta, versus apicem fusco-maculata; anfractus 7, *convexiusculi, lineis incrementi tenuissimis et obliquis striati, lente regulariter crescentes, ultimus brevis, circa rimam angustam nigro tinctus; apertura inverse auriformis, pallide flavescens, linea rufo-purpurea mediana picta, longit. totius* $\frac{1}{3}$ *paulo superans; peristoma album, breviter expansum et reflexum, margine columellari incrassato breviter dilatato.*

Longit. 31 *millim., diam.* 14; *apertura* 11 *longa, intus* 7 *lata.*

Hab. Meri, Sarawak (*C. Hose*).

A small species, rather like *A. suspectus*, Martens, from Timor and Sumbawa. It is differently coloured, the increase of the whorls is slower, and the body-whorl and aperture are smaller. The apex is not black, and the fourth and fifth volutions exhibit some pale brown spots or stripes. Only a single specimen examined.

47. CYATHOPOMA EVERETTI. (Plate III. figs. 21, 22.)

Testa minuta, aperte et perspective umbilicata, breviter conoidea, cornea; anfractus $4\frac{1}{2}$, *primi duo læves, convexi, magni, nucleum obtusum formantes, penultimus tricarinatus, carina mediana aliis magis conspicua, ultimus circa medium tricarinatus, circa umbilicum carina tenui prominente et intus carinis duobus minoribus instructus, inter carinas microscopice reticulatus; apertura subtriangularis, inferne acuminata, effusa; peristoma continuum, margine externo ad carinas triangulato, intus paulo incrassato, columellari arcuato, tenuiore.*

Diam. maj. 2 *millim., alt* 2.

Hab. Rumbang, Sarawak.

A minute species, well characterized by the strong carinæ, the large apex, and triangular aperture.

48. PTEROCYCLOS LATILABRUM. (Plate III. figs. 23–25.)

Testa P. tenuilabiato *similis, sed spira minus depressa, umbilico profundiore, paulum contractiore, superficie haud corrugata, labro latius expanso, operculo nucleum versus arctius convoluto.*

Hab. Gomanton Hill, N. Borneo.

The very broad, thin, light brown or lilac-brown lip is in itself sufficient to distinguish this species. Most of the specimens are of a pale yellowish-olive tint, varied above with radiating jagged and zigzag red lines. Others, however, are of a deeper reddish-brown colour. The epidermis is smoother and more silky than that of *P. tenuilabiatus*, and the peculiar wrinkling of the surface of that species is entirely absent in the present form.

ALYCÆUS.

Ten species of this genus are now known from Borneo, namely—*globosus,* H. Ad., *galbanus,* Godwin-Austen, *hosei,* G.-A., *everetti,* G.-A., *specus,* G.-A., *spiracellum,* Adams & Reeve, *broti,* Aldrich, *dohrni,* Boettger (=*hochstetteri,* Martens *non* Pfeiffer), *rimatus,* Bttgr., and *fultoni,* Moellendorff.

Of these, *A. everetti* and *A. broti* may be synonymous[1]; and *A. fultoni* has not yet been described, but the diagnosis (given on p. 117) has been kindly furnished by Dr. von Moellendorff.

49. ALYCÆUS GLOBOSUS, H. Adams.

Alycæus globosus, H. Ad. Proc. Zool. Soc. 1870, p. 794; Godwin-Austen, op. cit. 1889, p. 346, pl. xxxvii. figs. 3, 3 *a.*

Hab. Busau and Bau, Sarawak (*A. Everett*).

Var. MULUANA. Like the typical form, but having the peristome less produced into a tongue-like projection over the umbilicus.

Hab. Mulu Mountain (*A. Everett*).

Var. RABONGENSIS. A trifle larger and more globose than type, pale straw-colour or reddish; peristome as in var. *muluana.* Diam. maj. $5\frac{2}{3}$ millim., alt. $5\frac{1}{2}$.

Hab. Mount Rabong, Sarawak (*A. Everett*).

Var. KINA-BALUANA. Not quite so globose as type; spire taller, aperture smaller; peristome with even less production over the umbilicus than in the two preceding varieties: colour same as var. *rabongensis.*

Hab. Kina Balu, N. Borneo (*A. Everett*).

Var. PYGMÆA. Like var. *muluana* in miniature, but more coarsely and distantly lamellated, and with the peristome even less bent back over umbilicus. Diam. maj. $3\frac{1}{2}$ millim., alt. $3\frac{1}{3}$.

Hab. Mulu Mountain.

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[1] Since this was written, specimens of *A. everetti,* sent by Mr. Fulton, have been compared by Mr. Aldrich with his *A. broti,* and he has written, saying "they are the same thing." The diam. 7 mm. was a mistake, and should be "about $4\frac{1}{2}$ mm."

Although the differences between the extreme forms of this species are considerable, still there is such a general resemblance throughout the series, that it seems advisable to consider the various forms as local races of one and the same species rather than to describe them as distinct. The variation in the tongue-like reflection of the peristome over the umbilicus is one of degree, passing from the typical form, where it is obvious, to the var. *pygmæa*, where it is almost imperceptible.

50. ALYCÆUS HOSEI, Godwin-Austen.

Alycæus hosei, G.-A. Proc. Zool. Soc. 1889, p. 347, pl. xxxvii. f. 2.

Hab. Busau and Rumbang Hills, Sarawak (*Everett*).

In the description of this species the apex of the spire is said to be "pointed." In both the figure, however, and the shells also, it certainly is blunt. It is distinguished from *A. dohrni* thus: "apex distincte obtusior; tubulus suturalis aperturæ magis approximatus; *apertura subverticalis*, non diagonalis; peristoma utrinque distincte auriculatum, margine columellari cum basali angulum efficiente perdistinctum etc." (Dr. O. Boettger *in litt.*).

51. ALYCÆUS (ORTHALYCÆUS) CONGENER. (Plate III. fig. 26.)

Testa A. hosei *similis, sed minor, spira elatiore, graciliore, anfractu ultimo minus gibboso, peristomate expanso, duplice, margine columellari reflexo, ad umbilicum sinuato, haud oblique rectilineare.*

Diam. maj. 5⅓ *millim., alt.* 6.

Hab. Mulu and Barit Mountains, Sarawak.

In colour and general appearance this species looks very like *A. hosei*. It differs, however, in the above particulars. It also, in some specimens, exhibits traces of spiral striæ. In *hosei* the inner peristome is somewhat porrected, in this form it is more reflexed. The sinuation at the umbilicus is very peculiar.

52. ALYCÆUS (ORTHALYCÆUS) SADONGENSIS. (Plate III. fig. 27.)

Testa A. fultoni *similis, sed paulo minor, grisea, umbilico latiore, anfractibus quinque, oblique costulato-striatis et spiraliter tenuissime striatis, ultimo minus gibboso, peristomate expanso, tenui, haud duplice.*

Diam. maj. 5⅓ *millim., alt.* 5⅓.

Hab. Sadong, Sarawak (*Everett*).

Although not mentioned by Dr. Moellendorff in the following description, excessively minute spiral striæ exist in *A. fultoni*; they are visible only under the microscope, and are less observable than in the present species. The spire of the latter is slightly less elevated and the whorls more rounded than in *A. fultoni*.

53. ALYCÆUS (ORTHALYCÆUS) FULTONI, Mlldff. (Plate III. fig. 28.)

"*T. perforata, elate turbinata, sat tenuis, subpellucida, confertim costulato-striata, læte citrina; spira valde elevata, subregulariter* *conica, apice glabrato, acutulo. Anfractus* 6, *perconvexi, sutura valde profunda disjuncti, ultimus medio valde inflatus, gibber,* 4–5 *mm. pone aperturam profunde constrictus, tum paullum ascendens, ad aperturam campanulatus, vix descendens. Apertura sat obliqua, subcircularis, peristoma duplex, externum late expansum, haud reflexum, ad insertionem paullum dilatatum, internum subporrectum.*

"*Diam. maj.* 7, *alt.* 6·75 *mm.*

"*Hab.* prope Gomanton insulæ Borneo.

"This form was sent to me as *A. hosei*, G.-A., var., but it is decidedly different from that species, which has a more elevated spire, the last whorl much less tumid, the outer peristome much broader and almost auriculated at the insertion, the columella deeply sinuate, paler colour, etc. In fact the nearest relation of the new species is none of the Bornean *Alycæi*, but *A. jagori*, v. Mart., of Java. It differs from the latter by greater size, half to one whorl more, the deeper constriction, the last whorl hardly deflected and therefore the less oblique aperture." (*Moellendorff.*)

54. OPISTHOSTOMA OTOSTOMA, Boettger.[1] (Plate IV. fig. 19.)

Hab. Busau (*Everett*); Brunei (*Boettger*).

55. OPISTHOSTOMA COOKEI, Smith. (Plate IV. fig. 20.)

Hab. Sarawak.

56. OPISTHOSTOMA DEPAUPERATUM, Smith. (Plate IV. fig. 21.)

Hab. Barit Mountain.

57. OPISTHOSTOMA AUSTENI, Smith. (Plate IV. fig. 22.)

Hab. Rumbang, Sarawak.

58. OPISTHOSTOMA PUMILIO, Smith. (Plate IV. fig. 23.)

Hab. Rumbang.

59. CYCLOPHORUS KINA-BALUENSIS. (Plate IV. fig. 1.)

Testa aperte umbilicata, suborbicularis vel depresse conica, in medio carinata, rufa, lineis angustis pallidis sutura radiantibus picta, epidermide tenui olivacea induta; anfractus 4½, *convexiusculi, celeriter crescentes, lineis incrementi tenuibus striisque spiralibus conspicuis sculpti, ultimus ad peripheriam primo acute carinatus (carina versus aperturam minus acuta), infra convexiusculus, lineis concentricis paucis nigro-rufis pictus; apertura obliqua, sordide albida; peristoma incrassatum, pallidum vel rufum, margine superiore vix expanso, columellari leviter reflexo.*

Diam. maj. 45, *min.* 33, *alt.* 27 *millim.*; *apertura intus* 16 *alta,* 19 *lata.*

Hab. Kina Balu, N. Borneo.

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[1] For reference to this species and descriptions of the four following, see Ann. & Mag. Nat. Hist. 1894, vol. xiv. pp. 271–273.

Only two specimens of this species were collected. It is about the same size as *C. borneensis*, but differs from that species in colour, in the much stronger spiral striæ, and more rapidly enlarged whorls. In one example the extreme edge of the peristome, which is reddish, is quite sharp, but it is soon thickened on the outside by a conspicuous ridge. In the second specimen the lip is dirty whitish and rather more expanded.

60. CYCLOPHORUS COCHRANEI, Godwin-Austen. (Plate IV. fig. 2.)

Cyclophorus cochranei, G.-A., Proc. Zool. Soc. 1889, p. 334.

Hab. Meri, Sarawak (*C. Hose*); Busau and Niah (*A. Everett*).

This species has the body-whorl on the left side above the periphery more or less flattened, and has rather a humpy or shouldered appearance near the suture. This species, *C. talboti*, and *C. borneensis* probably pass one into the other, although the representative forms are recognizable enough.

Two of the specimens from Meri are of a pale pinkish-brown colour, with a darker broad infra-peripheral zone. The third example is entirely white beneath an olive epidermis. The latter form closely resembles the variety *ochracea*.

61. LEPTOPOMA GEOTROCHIFORME. (Plate IV. fig. 3.)

Testa fere obtecte perforata, trochoidea, ad peripheriam acute carinata, subtus planiuscula, alba; spira conica, acuta; anfractus 6, *celeriter crescentes, leviter convexi, spiraliter tenuiter striati, lineisque incrementi obliquis, flexuosis, tenuissimis sculpti, ultimus supra et infra carinam concave compressus, antice haud descendens; apertura subcircularis; peristoma duplex, margine externo tenui expanso, ad angulum acuminato, latiore supra quam infra, interno continuo, paulo incrassato.*

Diam. maj. 22 *millim., min.* 17, *alt.* 20; *apertura intus* 9 *longa*, 9½ *lata.*

Hab. Mount Rabong, West Sarawak.

This species has a considerable resemblance to *L. undatum*, Metcalfe, and *L. niahense*, Godwin-Austen[1].

It is at once distinguished from the latter by the absence of the constriction behind the labrum, the double peristome, the almost concealed umbilicus, the more convex whorls, and slightly finer sculpture. *L. undatum* also has the body-whorl constricted behind the lip, but the peripheral keel becomes obsolete a little from it, so that there is hardly any acumination on the right of the aperture as in the present species and *L. niahense*. *L. undatum* is more openly umbilicated and has not a double peristome.

62. LEPTOPOMA SKERTCHLYI. (Plate IV. fig. 4.)

Testa L. undato *similis, sed minor, carina peripherali usque ad labrum continua, anfractu ultimo pone aperturam haud constricto,*

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[1] Erroneously described as a *Helix* of the section *Geotrochus* (Proc. Zool. Soc. 1891, p. 44).

lineis incrementi obliquis supra et infra validis, pliciformibus, umbilico mediocri ut in L. undato; *apertura oblique ovata; perist. duplice, margine externo late expanso, acuto, haud reflexo, interno continuo, leviter porrecto; anfractibus superioribus planiusculis, liris paucis spiralibus tenuibus cinctis.*

Longit. 16½ *millim., diam. maj.* 17½, *min.* 13½: *apertura intus* 6 *longa*, 7 *lata.*

Hab. Summit of Mount Ambun, British North Borneo, at an elevation of 3500 feet.

This species was collected by Mr. S. B. J. Skertchly, who observes on a ticket accompanying the two specimens, kindly presented to the British Museum by Mr. J. J. Walker, "animal emerald-green, so the shell looked green with white porcelain bands."

Its small size and strong sculpture distinguish this species from its allies, *L. undatum*, *L. niahense*, and *L. geotrochiforme*.

63. Lagochilus bangueyensis. (Plate IV. fig. 5.)

Testa depresse turbinata, anguste umbilicata, tenuis, epidermide dilute olivacea, setosa induta; anfractus 6, *celeriter accrescentes, convexi, spiraliter lirati, superiores saturate rufescentes, cæteri strigis rufis radiantibus ornati, ultimus inferne haud strigatus, infra peripheriam zona angusta rufa pictus, supra medium liris circa* 8–9 *instructus, infra lineis impressis circa* 6 *remotis et subpunctatis sculptus; apertura fere circularis, mediocriter magna; peristoma duplex, tenue, margine externo vix expanso, interno continuo, pallido, leviter incrassato, ad suturam minute sinuato.*

Diam. maj. 13 *millim., min.* 10, *alt.* 11; *apertura* 6 *lata.*

Hab. Banguey Island, North Borneo.

This species is clothed with a very hairy epidermis; the hairs are short, dark brown, situated upon the spiral liræ and the impressed lines on the base of the body-whorl, and at the same time they form oblique series in the direction of the lines of growth. The epidermis is easily cleaned off, the shell then having a very different look. The red radiating markings are curved and somewhat wavy, but do not extend beyond the middle of the body-whorl.

64. Lagochilus rabongensis. (Plate IV. fig. 6.)

Testa turbinata, umbilicata, sub epidermide tenui flavo et rufo oblique strigata, spiraliter lirata; anfractus 5–6, *convexi, liris tenuibus spiralibus (in anfr. penult. quatuor) cincti, ultimus liris circiter* 8–10 *ornatus, antice vix descendens; apertura rotundata, mediocris; peristoma duplex, margine externo tenui plane reflexo, intus leviter incrassato, dilute lilaceo, continuo, ad suturam minute sinuato.*

Diam. maj. 9 *millim., min.* 7⅓, *alt.* 8; *apertura intus* 3½ *lata.*

Var. *Testa minor, omnino lutescens vel strigis rufis radiantibus ornata. Diam. maj.* 7 *millim., min.* 6, *alt.* 7.

Hab. Mount Rabong, West Sarawak (*A. Everett*).

The typical form of this species is a little larger than *L. triliratus*, Pfr. It differs also in the greater number of spiral liræ and the stronger and more widely reflected lip. The variety is conspicuously smaller than the type and has a paler appearance. One of the three specimens examined is of a uniform pale olivaceous tint, the two others having a few more or less distant radiating stripes or spots.

L. bellulus, Martens, has four liræ upon the penultimate whorl, but about 14 on the last, and the red stripes are flexuous and the umbilicus broader.

65. Lagochilus kina-baluensis. (Plate IV. fig. 7.)

Testa subaperte umbilicata, depresse turbinata, lutescens, rufo-nigro radiatim et undulatim strigata, spiraliter tenuissime striata, liris tenuibus (in anfr. ult. duo, ultimo quatuor) cincta, epidermide setosa induta; anfr. 6, convexi, superiores tres saturate rufescentes, sequentes duo in medio carina vel lira cincti, inferne ad suturam lira secunda ornati, ultimus carina vel lira suprema paulo supra medium sita, infima circa medium basis, antice vix descendens; peristoma recte reflexum, margine externo tenue, lutescente, interno continuo, leviter incrassato, sublilaceo, ad suturam minute sinuato.

Diam. maj. 9 *millim., min.* 7, *alt.* 7; *apertura intus* 3½ *lata.*

Hab. Kina Balu, 3000–4000 feet (*A. Everett*).

Very like *L. inornatus* in form, but differing in the number of the spiral liræ, the spiral striæ, and colour. The short brown hairs of the epidermis arise from the spiral liræ.

66. Lagochilus conicus. (Plate IV. fig. 8.)

Testa anguste perforata, conica, lutescens, rufo radiatim strigata, epidermide tenui setosa induta, spiraliter tenuissime lirata; anfractus 6, *convexi, regulariter, haud celeriter accrescentes, ultimus antice vix descendens; peristoma tenue, duplex, margine externo angustissime expanso, nigrescente, interno leviter incrassato, pallide livido, continuo, ad suturam minute sinuato.*

Diam. maj. 8 *millim., min.* 7, *alt.* 8½; *apertura intus* 3½ *lata.*

Hab. Kina Balu, 3000–4000 feet (*A. Everett*).

The spiral liræ are rather feeble, four on the penultimate, and none below the periphery of the last.

67. Lagochilus balabacensis. (Plate IV. fig. 9.)

Testa L. trilirato *similis, sed anfr. ultimo in umbilico liris tribus ornato, epidermide decidua lutosa induta.*

Diam. maj. 8 *millim., min.* 6⅔, *alt.* 7; *apertura* 4 *lata.*

Hab. Island of Balabac, between Palawan and Borneo (*A. Everett*).

This species is of the same size and colour as *L. triliratus*, Pfr., from Labuan, and the latter has four liræ encircling the body-whorl, of which the lowermost is around the *middle* of the base. The present species has six liræ, the upper three situated as in

L. triliratus. The fourth lira surrounds the umbilicus, and the two others are within it. The epidermis seems somewhat different, and the peristome is a trifle less thickened than in the Labuan species. These appear to be small differences; still, they will probably prove to be constant in specimens from the two localities.

68. Lagochilus mundyanus, Godwin-Austen.

Lagochilus mundyanus, G.-A. Proc. Zool. Soc. 1889, p. 338, pl. xxxix. figs. 6–6 *b*.

Lagochilus altus, Smith, Journ. Linn. Soc., Zool. vol. xxiv. p. 345, pl. xxv. fig. 9.

Hab. Busau Hills.

I regret having overlooked Godwin-Austen's *L. mundyanus* when describing *L. altus*. They are undoubtedly identical. A specimen recently received differs from the typical form in being of a uniform dark purplish-brown colour.

69. Lagochilus quadricinctus. (Plate IV. fig. 10.)

Testa parva, anguste umbilicata, turbinata, tenuis, pellucido-albida, ad apicem fuscescens; anfractus 5½, supremi 2–3 convexi, læves, penultimus convexiusculus, bicarinatus, ultimus mediocriter convexus, carinis quatuor cinctus; apertura fere circularis; peristoma subduplex, tenue, late expansum et recurvum, margine interno columellari ad suturam minute inciso.

Diam. maj. 8¼ *millim., min.* 6, *alt.* 8; *apertura intus* 3⅓ *longa et lata.*

Hab. Mulu, N. Sarawak.

This species is somewhat like *L. baritensis*, Smith, but is much smaller, without colour-markings, has larger nuclear whorls, and is differently keeled. The peristome also is more widely expanded and not so distinctly double.

70. Diplommatina rubicunda (Martens).

Paxillus rubicundus, Martens, Preuss. Exped. Ost-Asien, Zool. vol. ii. p. 164, pl. 4. fig. 16.

Diplommatina rubra, Godwin-Austen, Proc. Zool. Soc. 1889, p. 349, pl. xxxviii. fig. 7.

Diplommatina rubicunda, Smith, Ann. Mag. N. H. 1894, vol. xiii. p. 463.

Hab. Bengkajang and Singkawang, W. Borneo (*Martens*); Niah Hills (*Godwin-Austen*); Mt. Rabong, West Sarawak, Kina Balu, and Gomanton, North Borneo, also Palawan (*Everett, in present coll.*); Natuna Islands (*Smith*).

The intensity of the reddish colour is variable, and the outer peristome is more remote from the inner in some specimens (*e. g.* those from the Natuna Islands) than in others.

71. Diplommatina recta. (Plate IV. fig. 11.)

Testa dextrorsa, ovata, superne acuminata, cornea; anfractus 6, *perconvexi, lamellis tenuissimis obliquis numerosis ornati,*

ultimus penultimum subæquans; apertura irregulariter rotundata, verticalis; peristoma incrassatum, expansum, duplex, marginibus conniventibus, callo tenui junctis, columellari intus dente acuto munito.

Longit. 3 *millim., diam* 1½.

Hab. Kina Balu.

Var. *Testa minor, paulo angustior, pallide rufescens.*

Hab. Balabac.

The above differences seem hardly sufficient to distinguish this variety from the typical form.

72. DIPLOMMATINA BALABACENSIS. (Plate IV. fig. 12.)

Testa minima, elongata, ovato-fusiformis, sordide albida, dextrorsa, imperforata; anfractus 7–8, convexi, tenuiter lamellati, lamellis supra anfractum penult. confertioribus quam supra; anfr. ultimus penultimo minor, antice ascendens; apertura verticalis, rotundata; peristoma incrassatum, triplex, marginibus callo tenui junctis, columellari dente minuto intus munito.

Longit. 2 *millim., diam.* ¾.

Hab. Balabac.

This is smaller than any of the Bornean species. There is a marked difference in the proximity of the fine lamellæ, or threads, upon the penultimate whorl and that above it. The genus *Diplommatina* has not previously been recorded from this island.

73. DIPLOMMATINA BARITENSIS, Smith.

Diplommatina baritensis, Smith, Journ. Linn. Soc., Zool. vol. xxiv. p. 350, pl. xxv. fig. 22.

Hab. Kina Balu, Busau, Rumbang, and Banguey Island.

None of the specimens from these localities agree exactly with the type from Barit Mountain. In form they correspond very closely, but none are so distinctly and distantly lamellated. Those from Kina Balu, Busau, and Rumbang are of a dirty yellowish tint, becoming reddish towards the apex of the spire, and the peristomes are bright yellow. The specimens from Banguey Island appear almost smooth at first sight, the fine costulation being observable only under a powerful lens. They are pale and subpellucid like the type, and the peristome also is likewise whitish. Some of the yellow lips are rather more thickened than in the typical form.

In the figure the spire above the penultimate whorl is not long enough and too broad. Some specimens bear considerable resemblance to *D. concinna*, H. Adams, but the penultimate whorl is larger in proportion to the last.

74. DIPLOMMATINA CONCOLOR, Quadras & Moellendorff. (Plate IV. fig. 13.)

Diplommatina (*Sinica*) *concolor*, Q. & M. Nachrichtsbl. deutsch. mal. Gesell. 1893, p. 182.

Hab. Cagayan, Luzon (*Q. & M.*); Palawan (*Everett*).

The Palawan specimens have half a whorl less than those from Luzon, the spire above the penultimate volution appearing in consequence a trifle shorter. The sculpture, form of aperture, and columellar denticle are the same [1].

75. PUPINA HOSEI, Godwin-Austen.

Pupina hosei, G.-A. Proc. Zool. Soc. 1889, p. 351, pl. XXXIX. figs. 1, 1 *a*.

Hab. Busau (*type*); Mulu Mountain and Mount Rabong, Sarawak; also Balabac and Palawan (*A. Everett*).

This species is rather variable in size, even among specimens from the same locality. Some examples are stouter than others, and one from the cave-earth, in a semi-fossilized condition, has an exceptionally tall spire. There is very little variation in the form of the aperture, the peristome, and sinuses.

76. CYCLOTUS PALAWANICUS. (Plate IV. fig. 14.)

Testa orbicularis, aperte umbilicata, dilute castanea, infra medium paulo pallidior, lineis incrementi tenuibus striata, subpolita; spira depressa, apice obtuso, prominulo; anfractus 5, convexi, celeriter accrescentes, sutura profunda sejuncti, ultimus antice leviter descendens; apertura mediocris; peristoma duplex, margine externo superne lato, tenui, haud reflexo, prope suturam concave dilatato, interno continuo, infra suturam leviter sinuato, umbilicum versus cum externo conjuncto et incrassato; operculum utrinque leviter concavum, ad marginem bicarinatum, inter carinas acutas excavatum, sordide albidum, ex anfractibus nonis oblique striatis constitum.

Diam. maj. 21 *millim., min.* 15, *alt.* 10; *apertura intus* 7 *longa et lata.*

Var. PARVA. *Testa minor, concolor, vel supra plus minus maculata; peristoma angustius expansum. Diam. maj.* 15½ *millim.*

Hab. Maranggas, S.W. Palawan.

If very carefully examined, a very faint peripheral zone is traceable.

77. CYCLOTUS PUSILLUS (Sowerby).

Cyclostoma pusillum, Sowerby, Thes. Conch. vol. i. p. 94, pl. 23. figs. 5, 5*; Pfeiffer, Conch.-Cab. ed. 2, p. 59, pl. 7. figs, 16, 17.

Cyclotus pusillus, Reeve, Con. Icon. fig. 39; Hidalgo, Journ. de Con. 1888, p. 57.

Hab. Luzon and Negros, Philippines (*Sowerby*); Marinduque and Cebu (*Hidalgo*); Palawan (*Everett*).

Two specimens from Palawan, 9 millim. in diameter, are peculiar in having the last half of the body-whorl disconnected with the penultimate.

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[1] In my Report upon the Land-Shells of the Natuna Islands, I named a species belonging to this genus *D. strubelli*. I regret to find that that name had already been used, and propose therefore to change it to *D. brunonis*.

78. Cyclotus linitus, Godwin-Austen.

Cyclotus linitus, Godwin-Austen, Proc. Zool. Soc. 1889, p. 345, pl. xxxvi. fig. 3.

Hab. Mount Rabong, West Sarawak.

Some of the specimens from this locality are larger than the types from Busau, being 10 millim. in their greater diameter. With the exception of the apex, they are entirely coated with the thick earthy deposit, which is possibly to some extent protective. The body-whorl descends in front, and is slightly detached from the penultimate at the aperture.

79. Helicina usukanensis, Godwin-Austen.

Helicina usukanensis, G.-A. Proc. Zool. Soc. 1889, p. 352, pl. xxxix. fig. 7.

Hab. Mengalun Island, Usukan Island, Banguey Island, Mantangak Island, and Palawan; also Sibutu and Bilatan, Sulu Islands (*A. Everett*).

The specimens from Sibutu and Bilatan were at one time supposed to belong to *H. contermina*, Kobelt[1]. That species, judging from the description, appears to be somewhat more globose, and the keel is said to be thread-like ("carina filiformi"). Perhaps a comparison of specimens, however, may yet show that they really are the same as that species. I have no hesitation in placing all the specimens from the above localities under *H. usukanensis*, although there are slight differences in size and the colour is variable. It may be uniformly yellowish or pinkish red, but the keel is always whitish, and a narrow reddish zone beneath the carina is more or less visible in most specimens.

80. Georissa everetti. (Plate IV. fig. 15.)

Testa turbinata, imperforata, rufescens, lineis obliquis minute decussata; anfractus 4, perconvexi, primus lævis, globosus, ultimus antice subdescendens; apertura rotunde ovata; peristoma tenue, marginibus callo tenui junctis, columellari pallido, reflexo.
Longit. 2 millim., diam. 1½; *apertura* 1 *longa,* ¾ *lata.*

Hab. Rumbang, W. Sarawak.

Only a single specimen of this pretty species was collected by Mr. Everett. It is distinguished from all the other Bornean species by the decussation of the surface, formed by the minute curved lines of growth being crossed by others obliquely sloping in the opposite direction. Under a powerful lens the points of intersection appear somewhat granulous.

81. Georissa bangueyensis. (Plate IV. fig. 16.)

Testa turbinata, rufescens, fere lævis; anfractus 4, perconvexi, sutura profunda sejuncti, lineis incrementi obliquis substriati, primus subglobosus; apertura oblique semicircularis; peristoma

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[1] Ann. Mag. Nat. Hist. 1894, vol. xiii. p. 59, pl. iv. figs. 6, 6 *a*.

vix incrassatum, marginibus callo tenui junctis, columellari supra regionem umbilicalem fortiter reflexo, callum crassum formante.

Longit. $1\frac{2}{3}$ *millim., diam.* $1\frac{1}{3}$; *apertura* $\frac{2}{3}$ *longa,* $\frac{1}{2}$ *lata.*

Hab. Banguey Island.

The strong callus over the umbilical region is a characteristic feature. There is very little surface-sculpture observable, merely very faint lines of growth and a few minute spiral striæ on the body-whorl, visible only under the microscope.

82. GEORISSA FLAVESCENS. (Plate IV. fig. 17.)

Testa globose turbinata, flavescens, spiraliter striata ; anfractus tres, primus lævis, globosus, secundus convexiusculus, superne subhumerosus, ultimus magnus, subglobosus ; apertura semicircularis, obliqua, longit. totius $\frac{1}{2}$ *adæquans ; peristoma leviter incrassatum, marginibus callo tenui junctis, columellari oblique rectiusculo, reflexo, supra umbilicum callum crassiusculum formante.*

Longit. $1\frac{2}{3}$ *millim., diam.* $1\frac{1}{2}$; *apertura* $1\frac{1}{4}$ *longa,* $\frac{3}{4}$ *lata.*

Hab. Gomanton, N.E. Borneo.

Although spirally sculptured somewhat similarly to *G. hosei*, this species differs in colour and the less angular penultimate whorl.

83. GEORISSA BORNEENSIS. (Plate IV. fig. 18.)

Testa imperforata, turbinata, rufescens ; anfractus quatuor, convexi, sutura canaliculata sejuncti, oblique striati, primus globosus, lævis, ultimus antice paulo descendens, ad medium obtuse subangulatus ; apertura parva ; peristoma rufum, intus limbatum, marginibus callo tenui junctis, columellari obliquo, vix arcuato, reflexo.

Longit. $2\frac{1}{2}$ *millim., diam. fere* 2 ; *apertura* 1 *longa,* $\frac{2}{3}$ *lata.*

Hab. Gomanton, N.E. Borneo.

This species has no spiral sculpture, but exhibits merely fine striæ of growth. The outer lip is distinctly thickened within and of a bright red colour.

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3. On the Long-lost *Putorius africanus*, Desm., and its Occurrence in Malta. By Oldfield Thomas.

[Received January 15, 1895.]

In 1875 Mr. C. A. Wright, to whom ornithologists are indebted for several additions to the fauna of Europe, due to his study of the birds of Malta, read a paper before this Society[1] on the large Weasel or "Ballottra" of that island. This animal he compared with various species which had been described from the Mediterranean area, but owing to want of material he was unable definitely to determine it. His specimen he was good enough to present to the National Museum, where it has remained unique until recently, when the same gentleman contributed to the Collection a young male and an immature female, and the examination of these fresh examples has given rise to the present remarks.

As stated by Mr. Wright in his paper, the adult male is as large as a large Stoat, with an equally long tail, while it has the uniform coloration of the latter organ characteristic of the Weasel.

On looking up the British Museum material bearing on the subject, happily considerably increased since the time of Mr. Wright's paper, I find a couple of skins, male and female, from Egypt[2], presented and collected by Dr. John Anderson in 1892; and the same energetic collector has also placed at my disposal a fine alcoholic male obtained at Cairo during his last season's explorations.

These Egyptian Weasels, so far as can be judged by external proportions and coloration, appear to me to be clearly conspecific with the Maltese form, and the question therefore arises as to what name should be applied to them.

In the invaluable work[3] on the Mammals of Barbary published in 1885 by M. Fernand Lataste, we find an important discussion on the Weasels of N. Africa, continued and revised by him in his 'Mammals of Tunis' (1887), and supplemented in both places by some notes by Dr. Trouessart, so that we have here the last opinions pronounced on the subject by the two ablest and most modern French students of the Mediterranean fauna.

Briefly epitomized, their opinions are:—(1) that there is only a single form of Weasel in North Africa, closely allied to *P. vulgaris* and *P. boccamela*; (2) that if distinct from both of these, which is doubtful, it should bear the name of *P. subpalmatus*, Hempr. & Ehr. (syn. *P. numidicus*, Puch.); and (3) that *Putorius africanus*, Desm., must have been based on a specimen not really from Africa at all, and perhaps belonging to a Japanese species.

Not a word could be said against these conclusions as based on the then available material, especially as at that date, in regard to mammalogy in general, we had far less knowledge of our ignorance than I trust we have since gained. It therefore often seemed legitimate to draw conclusions of a character we should not dare to draw now. But, viewed in the light of recent accessions, they clearly need modification, and, so far as I can venture to state at present, it seems evident:—

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[1] P. Z. S. 1875, p. 312.

[2] From the Pyramids of Ghizeh, and Abu-Roash, W. of Cairo.

[3] Act. Linn. Soc. Bord. xxxix. p. 129 *et seqq.* (1885).

1. That there are two distinct forms of Weasel in N. Africa, bearing to each other the same relation in size, and, if they overlap in distribution, no doubt in the struggle for existence, as the European Stoat and Weasel do.

2. That the larger of the two is the true *P. africanus*, Desm., practically lost to science since its description in 1818[1], and that the smaller only is the species referred to by Lataste and Trouessart, and, probably, by other authors who have considered "*P. africanus*" near to or identical with *P. boccamela*.

Of the smaller species the British Museum possesses as yet no authentic Egyptian examples, nor has Dr. Anderson met with it; but from some measurements of the specimens marked "*P. subpalmatus*" in the Berlin Museum, kindly supplied me by Dr. Matschie, it seems probable, as appears below, that the smaller Weasel also occurs in Egypt, in company with the giant species so excellently described by Desmarest three quarters of a century ago and practically lost ever since.

It is to this latter that I would refer Mr. Wright's Maltese Weasel, and would congratulate him on his rediscovery of so interesting an animal.

So far as the respective ranges of the two species are concerned, *P. africanus* has apparently not yet been met with in the western half of N. Africa, in Tunis, Algeria, or Morocco, the region studied by Lataste, although it may of course any day turn up there. If it is really absent, so that its only African locality is Egypt, its occurrence in Malta is of still further interest, as will be readily perceived on looking at the relative positions of the localities concerned.

On the other hand, the eastern distribution of the smaller species remains somewhat doubtful, for from Dr. Matschie's measurements of the four original specimens contained in Hemprich and Ehrenberg's collection it seems probable that the smaller, as well as the larger, Weasel occurs in Egypt.

These measurements, which are given (see p. 130), are those, as Dr. Matschie tells me, of two adult females and two young specimens, all hitherto looked upon as co-types of *P. subpalmatus*.

Now as the description of that animal consists simply of the statement that it is "*statura minor*" as compared with *P. vulgaris*, it is evident that the two larger specimens (A. 373 and 1004) cannot have been included in this description, so that the two smaller ones (Nos. 1003 and 1005) should alone be looked upon as the co-types of

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[1] N. Dict. d'H. N. (2) xix. p. 376.

Hemprich and Ehrenberg's name. These two specimens are of just about the size of the smaller N. African Weasel as given by Lataste, and I would suggest that they have been wrongly looked upon as young and that they are really adults of the smaller species, while the two larger specimens might be small females of *P. africanus*.

This point, on which the nomenclature of the smaller species if different from *P. boccamela*[1] will depend, can only be settled by a detailed examination of the Berlin types and their skulls, an examination which I trust Dr. Matschie may himself be able to undertake and give an account of.

That certain Egyptian Weasels are only of the size of *P. boccamela* is also borne out by the characters and measurements given by Hensel[2] of an original skull of *P. subpalmatus* belonging to a skeleton preserved in the Anatomical part of the Berlin Museum[3]. This skull is, however, unfortunately not sexed, and therefore the comparison of measurements may be between female *subpalmatus* and female *boccamela*. Still, Hensel does say distinctly that *P. subpalmatus* is a species "die allerdings mit der *Boccamela* identisch ist," although whether his assertion was based on an examination of external as well as cranial characters I have no means of knowing.

The following are some pertinent measurements of Mediterranean Weasels:—

	Head & body.	Tail.	Hind-foot.
"*Putorius boccamela*."	mm.	mm.	mm.
Sardinia (topotype). ♂ (in spirit) ..	206	79	36·6
do. do. ♀ do. ..	145	51	26
Algeria (*fide* Lataste). ♀ do. ..	162	46	26 (with claws).
"*Putorius subpalmatus*" (*fide* Matschie).			
Egypt. No. 1003[4] (stuffed)....	170	44	26
do. 1005[4] do.	170	42	26
do. 1004 ♀ do.	270	90	33
do. A. 373 ♀ do.	270	87	31
Putorius africanus.			
Egypt. ♂ (in spirit)	260	108	47
do. ♂ (skin)	..	..	41
do. ♀ (skin)	..	..	38
Malta. ♂ (stuffed)	(c.)300	105	43

In using the names *boccamela* and *subpalmatus* for present purposes, I do not wish to be taken as expressing any opinion as to the specific validity of the forms respectively so called, as the positions of both need much further investigation.

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[1] Lataste states that *boccamela* as a technical name dates only from 1835; but Bechstein's 'Naturgeschichte Deutschlands,' in which it occurs (vol. i. p. 819), was published in 1801, and I also notice that the species was binomially quoted by Fischer (Syn. Mamm. p. 224) in 1829, so that in any case it is of earlier date than *subpalmatus*.

[2] "Craniologische Studien," N. Act. Leop. xlii. pp. 177–179, Table S, column 4 (1881).

[3] No. 5661.

[4] The real co-types; see above.

Nor should I even like to say positively that *P. africanus* is specifically distinct from the large South-Italian Weasels, of which many more specimens will be needed before we can say whether or no they grade into the Maltese representative of the group. Indeed the only points that I can claim to have made out with any certainty are (1) that *P. africanus* is a genuine African animal, found in Egypt, and (2) that a practically identical form occurs in Malta.

4. On the Visceral Anatomy and Brain of *Dendrolagus bennetti*. By FRANK E. BEDDARD, M.A., F.R.S., Prosector to the Society.

[Received January 14, 1895.]

So far as I am aware the only published account of the visceral anatomy of this genus is a paper by the late Sir Richard Owen [1], which, moreover, deals with a different species. It seemed to me therefore to be worth while to put on record such additional facts as I have been able to observe concerning the structure of this aberrant genus.

Before proceeding to describe the anatomy of the viscera, there are two external characters to which I should like to call attention.

The first of these relates to the colour of the fur: the shorter and deeper-lying hairs in many parts of the body are of a pink colour, like that which colours the throat of *Macropus rubens*. This pink hue does not appear until the fur is ruffled and the deeper hair brought into view.

As to the second point, I must first refer to a paper by the late Prof. Garrod [2] upon *Dorcopsis luctuosa*. In that paper he described "four large and conspicuous glandular hair-follicles in the middle line, arranged to form a square," lying in the skin between the jaws. These are figured [3]. I observed nothing in *Dendrolagus* of so obvious an appearance as the structures figured by Garrod; but, when the skin was removed, two small black hair-follicles were easily visible lying side by side. From the apex of each of these proceeds a hair, which is not any longer than the other hairs upon the throat. I examined a specimen of *Petrogale penicillata*, and found that it exactly resembled *Dendrolagus bennetti* in this respect. Whether these structures represent in a rudimentary form the large and complicated sternal glands of *Myrmecobius* [4] and *Didelphys dimidiata* [5] I am unable to say.

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[1] "Notes on the Anatomy of the Tree-Kangaroo (*Dendrolagus inustus*, Gould)," P. Z. S. 1852, p. 103.

[2] "On the Kangaroo called *Halmaturus luctuosus* by d'Albertis, and its Affinities," P. Z. S. 1875, p. 48.

[3] *Loc. cit.* pl. viii.

[4] "Note on a Point in the Structure of *Myrmecobius*," P. Z. S. 1887, p. 527.

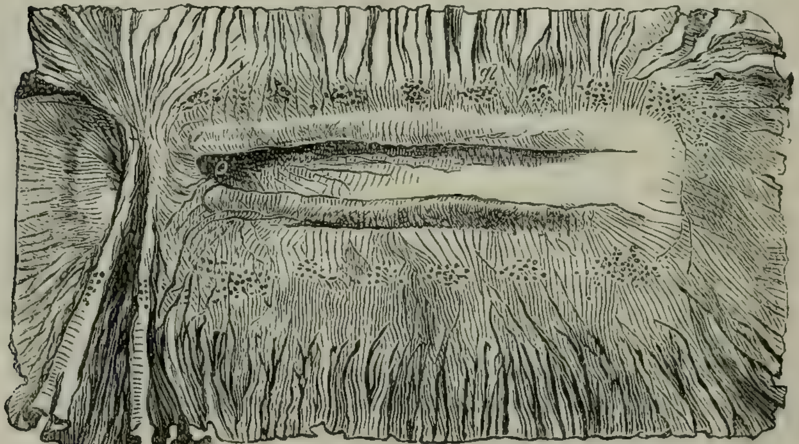
[5] "Note on the Sternal Gland of *Didelphys dimidiata*," P. Z. S. 1888, p. 353

When the animal was opened by a longitudinal incision through the abdominal walls a little to the left of the middle line, considerable traces of the ventral mesentery were apparent. From the bladder a fold of membrane arose, which was in parts at least an inch deep: this fold passed along the ventral body-wall about halfway to the ribs, and gradually died away. Close to the ribs it was resuscitated for the space of about an inch; but this section of the ventral mesentery was not continuous with the posterior section or with the falciform ligament in front. In all mammals (that I have examined) the bladder is attached to the parietes by a fold of membrane, which is, doubtless, so far the equivalent of the primitive ventral mesentery. But in no mammal, except *Ornithorhynchus*[1], have I noticed this fold to extend so far forward as in the Marsupial which forms the subject of the present paper. I could not, however, discover the least trace of any blood-vessels in any part of it. It was completely anangious.

§ *The Stomach and Intestines.*

The *stomach* in general appearance is very like that of the Kangaroo, but the cardiac *cul-de-sac* is not bifurcate, and the present species agrees in this with *D. inustus*, with *Dorcopsis*, and with *Petrogale*. In structure the stomach of the present species appears hardly to differ from that of *D. inustus*; but I am able to give a somewhat fuller account than that given by Sir R. Owen, and I have thought it worth while to have a drawing (fig. 1) prepared of the interior of the organ.

Fig. 1.



Stomach of *Dendrolagus*, with the interior displayed.
o, œsophageal orifice; *gl*, glandular patches.

The stomach is sacculated by two principal bands, which run laterally; but there are also others. At the cardiac extremity there is a single band on the side opposite to that at which the œsophagus enters; it dies away entirely after a course of about five inches. On the opposite side of the cardiac *cul-de-sac*, but a little way from the actual extremity, two bands form a **U**-shaped junction. Traced backwards, one of these two bands (that on side remote from entrance of œsophagus) has a very short course, but it nearly joins the strong lateral band of its side to which reference has already been made as extending right along the stomach as far as the pyloric end. The other loop of the **U** forms the strong band on the opposite side of the stomach. The interior of the stomach shows a very great contrast to that of *Petrogale penicillata*, with which I compared it. In the latter the entire cardiac end of the stomach is lined with a whitish epithelium continuous with that of the œsophagus. In *Dendrolagus* it is not; but the middle tract of the stomach leading from the œsophageal opening towards, but not as far as, the pylorus is lined with this epithelium. Round this, on both sides, there are patches of follicular glands of varying size, the largest being about half an inch long. Sir Richard Owen mentions these, and also two strong folds which start from either side of the œsophageal opening and run parallel with each other for a distance of about 3 inches towards the pylorus. The upper of these is faintly represented in *Petrogale*. There are also (in *Dendrolagus bennetti*) two folds which run downwards from the cardiac side of the œsophageal orifice and diverge from each other to form a **V**. They appear to form a kind of valve partly shutting off the cardiac *cul-de-sac*. They are also, though faintly, represented in *Petrogale penicillata*. The stomach of *Halmaturus* (fig. 2) is somewhat intermediate. It has the strong folds round the œsophageal orifice, but no patches of glands.

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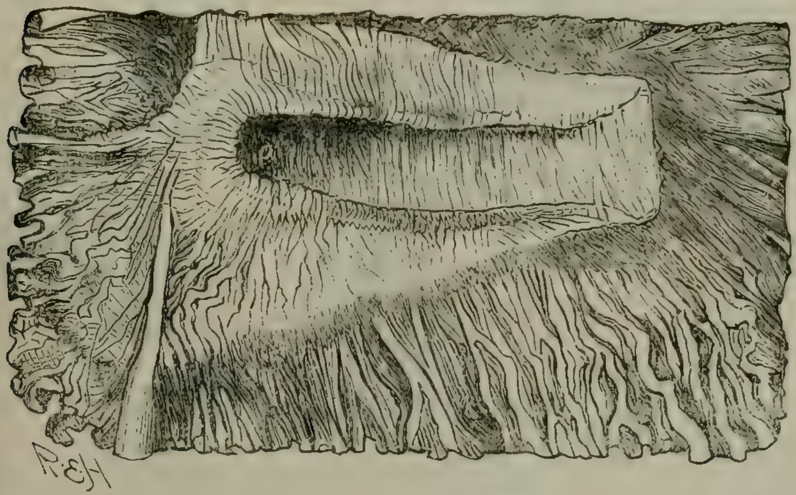
[1] "On some Points in the Visceral Anatomy of *Ornithorhynchus*," P. Z. S. 1894, p. 715.

Fig. 2.



Stomach of *Halmaturus*, with the interior displayed.
o, œsophageal orifice.

The *spleen* is $6\frac{3}{4}$ inches in length; it is narrow, but dilated in a spoon-like fashion at one end. The organ is not **T**-shaped, as in *D. inustus* and the Kangaroo.

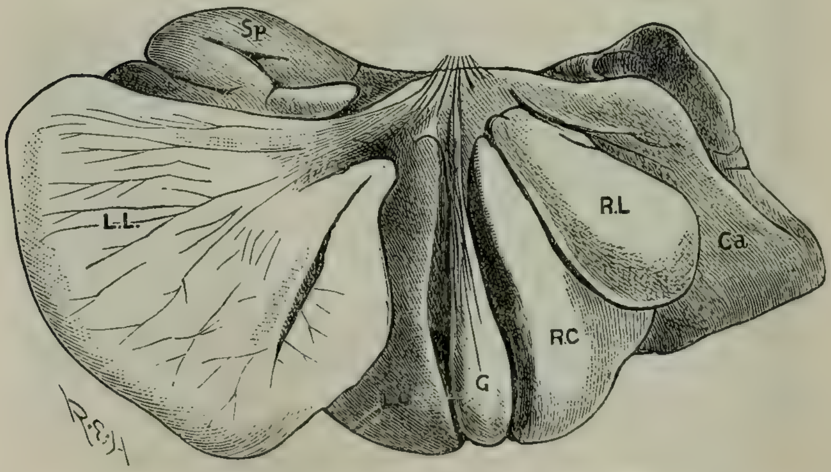
The *small intestine* measures 95 inches; I could only count 6 Peyer's patches in it. The conjoined bile and pancreatic ducts open into it at a distance of five inches from the pylorus. The *large intestine* neasured 38 inches; it has, as has the cæcum, plenty of Peyer's patches. Mr. Dobson, in recording[1] the existence of Peyer's patches in certain Insectivora, Rodentia, Marsupialia, and Lemurs, omitted to mention that Owen had discovered these structures as existing in the colon of *Dendrolagus inustus.*

The *cæcum* of the present species appears to be smaller than that of *D. inustus*, in which animal the measurements given by Owen are 5 × 5 inches. I found it to be 2 inches only in length and about the same in diameter. The cæcum is attached to the small intestine by a sheet of membrane. From the opposite side of the small intestine a fold comes over, which is attached to the first-mentioned membrane. It is for the most part anangious. The blood-vessel supplying the cæcum comes across from the ileocolic mesentery on the opposite side, where there is no connecting fold of membrane. The arrangement of the membranes supporting the cæcum is precisely the same in *Petrogale penicillata* and in *Halmaturus bennetti*; but in the former, at any rate, the accessory fold which joins the ileo-cæcal fold bears a blood-vessel along its free edge.

§ *The Liver.*

I have thought it worth while to have a drawing made of the liver of *Dendrolagus* (fig. 3), which was not particularly described by

Fig. 3.



Liver of *Dendrolagus*; abdominal surface.

Sp., Spigelian lobe; *L.L.*, left lateral; *L.C.*, left central; *R.C.*, right central; *R.L.*, right lateral; *Ca.*, caudate; *G*, gall-bladder.

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[1] J. Anat. Phys. 1884.

Owen in *D. inustus*. In the species which forms the subject of the present memoir, the liver formula may be represented on Garrod's plan thus:—

$$L.L.\ 2 > L.C. = R.C.\ 2 > R.L.\ 3 < Cau.$$

This formula differs markedly from that of *Petrogale penicillata*, which is as follows:—

$$L.L.\ 4 > L.C. = R.C. < R.L.\ 3 < Cau.$$

I am not disposed to think that very much stress can always be laid upon the relative sizes of the lobes of the liver. For example, in two species of *Halmaturus* the formulæ are as follows:—

H. bennetti. $L.L. < L.C. > R.C.\ 2 > R.L.\ 3 < Cau.$

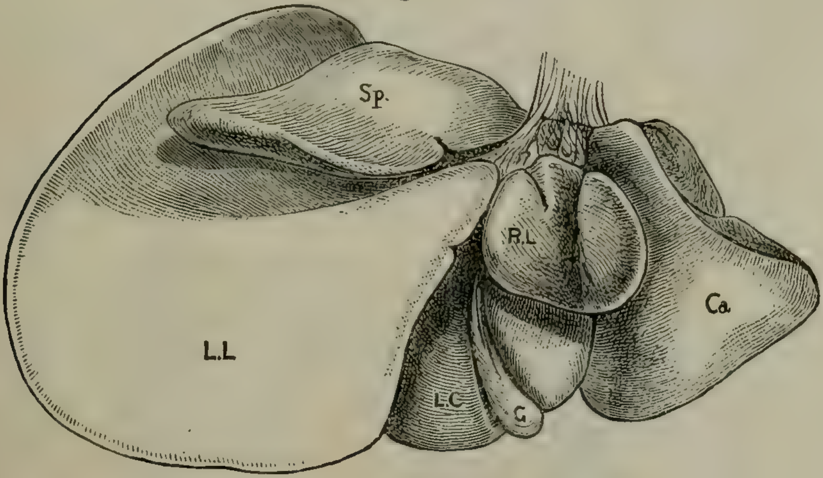
H. brachyurus. $L.L.\ 2 > L.C. = R.C. = R.L.\ 2 < Cau.$ (Garrod, MS. sketch).

On the other hand, the liver of *Dendrolagus* shows two characters by which it can be distinguished from that of all the above-mentioned species and from *Petrogale* (fig. 4) and *Macropus melanops*:—

(1) The right lateral lobe is not separated by a complete fissure from the caudate.

(2) The Spigelian lobe is distinctly bilobed.

Fig. 4.



Liver of *Petrogale*; abdominal surface.
Lettering as in fig. 3.

§ *Heart and Vascular System.*

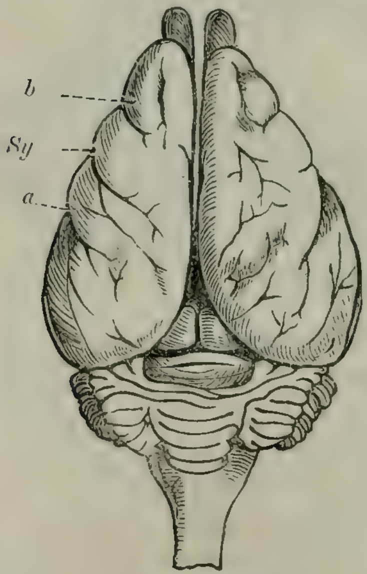
The only point that I noticed in the structure of the heart as compared with that of *Petrogale* is the presence of four separate papillary muscles attached to the free flap of the right auriculo-ventricular valve, instead of only three. The additional muscle was attached to the free wall of the ventricle.

The azygos vein shows considerable differences in different Marsupials; and I may take this opportunity of putting together the results of some recent dissections. In *Dendrolagus* there is nothing remarkable, the azygos is on the right side; but in *Halmaturus bennetti* there are two posterior cardinal veins nearly equally well developed, but longest on left side. In two specimens of this species dissected by me there were differences; in one the left azygos was much longer than in the other. *Petrogale penicillata* agreed with *Dendrolagus*; so too *Macropus rufus*. In *Phalangista vulpina* the difference was that the azygos vein was developed on the left side. In one specimen of the last-mentioned Marsupial the azygos opened directly into the vena cava posterior opposite to the entrance of the left kidney vein. The vena cava moreover was very largely absent. This state of affairs did not exist in the other individual. In *Didelphys cancrivora* and *Dasyurus maugæi* the left azygos vein was also developed and not the right. In *Didelphys azaræ* the same was the case, only the vein opened posteriorly into the vena cava opposite to renal vein; but the vena cava was not absent in front of this point.

§ *The Brain.*

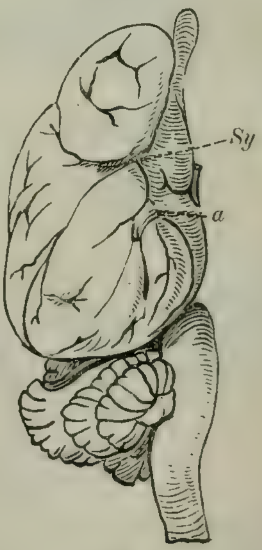
I have compared the brain of *Dendrolagus* with those of *Petrogale penicillata* and *Halmaturus bennetti*. It is about as large as that of the latter and bigger than the brain of *Petrogale*. The furrows are, however, less marked than in either of the types

Fig. 5.



Dorsal aspect.

Fig. 6.



Lateral view.

Brain of *Dendrolagus*.

Sy., Sylvian fissure; *b* anterior, *a* posterior fissure.

mentioned, even in the smaller *Petrogale*. Apart from a few furrows to which I shall call attention immediately, the surface of the brain of *Dendrolagus* is not exactly smooth. It is covered with numerous meandering lines, the imprint of blood-vessels, which I cannot compare with the furrows of the more richly convoluted brain of the Kangaroo.

The Sylvian fissure is faintly marked. In the Kangaroo and the Wallaby this fissure is encircled by an arch-like fissure as in the Carnivorous brain. In *Dendrolagus*, as may be seen by an inspection of the accompanying drawing (fig. 6, p. 136), this fissure appears to be represented by a deep groove posterior to the Sylvian fissure (*a* in the figure). The only other at all conspicuous sulcus upon the pallium of *Dendrolagus* is that indicated at *b* in the drawing (fig. 5). This fissure lies, as will be seen, in the extreme frontal region of the brain and is U-shaped. That this is an important fissure in the Marsupial brain appears to be shown by its presence also in *Macropus*, *Halmaturus*, *Petrogale*, and—a stronger argument still—in the small and nearly smooth brain of *Hypsiprymnus ogilbyi*.

February 19, 1895.

Sir W. H. Flower, K.C.B., LL.D., F.R.S., President,
in the Chair.

Mr. Arthur Thomson, the Society's Head Keeper, exhibited a series of Insects reared in the Insect-house in the Society's Gardens during the past year, and read the following Report on the subject:—

Report on the Insect-house for 1894.

Examples of the following species of Insects have been exhibited in the Insect-house during the past season:—

Silk-producing Bombyces and their Allies.

Indian.

Attacus atlas.
—— *cynthia.*
—— *ricini.*
Attacus pernyi.
Antheræa mylitta.

American.

**Attacus lebeaui.*
Samia cecropia.
Actias luna.
Telea polythemus.
—— *promethea.*
Hypochera io.

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* Exhibited for the first time.

African.

Bunea caffraria.
Gynanisa isis.
**Cyrtogone herilla.*
**Jana strigina?*
**Antheræa dione.*
Antheræa menippe.
Actias mimosæ.
**Eudæmonia argus.*
Lasiocampa monteiri.

Diurnal Lepidoptera.

European.

Papilio podalirius.
—— *machaon.*
Thais cerisyi.
Melitæa cinxia.
Vanessa polychlorus.
—— *antiopa.*
Limenitis populi.
Apatura iris.

American.

Papilio ajax.
—— *cresphontes.*
—— *asterias.*
*—— *ilioneus.*
Papilio turnus.
Limenitis disippus.
Goniloba tityrus.

African.

Papilio porthaon.
**Papilio corinneus.*

Nocturnal Lepidoptera.

Smerinthus populi.
—— *tiliæ.*
Sphinx ligustri.
—— *pinastri.*
—— *carolina.*
Deilephila vespertilio.
—— *euphorbiæ.*
*—— *lineata.*
Chærocampa elpenor.
Darapsa myron.
**Philampelus achemon.*
**Ceratomia amyntor.*
Saturnia pyri.
—— *carpini.*
Eacles imperialis.
**Eupalia trimaculata.*
**Eulimacodes scapha.*
**Parasa chloris.*
**Euglyphia hieroglyphica.*

* Exhibited for the first time.

Of the lepidopterous insects which I have the honour to place before the Meeting this evening the following are exhibited for the first time:—*Papilio ilioneus*, from North America; *Papilio corinneus*, from South Africa; *Antheræa dione*, *Cyrtogone herilla*, *Jana strigina*?, and *Eudæmonia argus*, from Sierra Leone; *Attacus lebeaui*, from Honduras; *Deilephila lineata*, *Philampelus achemon*, *Ceratomia amyntor*, *Eupalia trimaculata*, *Eulimacodes scapha*, *Parasa chloris*, from North America, and *Euglyphia hieroglyphica*, from Jamaica.

The most interesting of these insects are the specimens of *Eudæmonia argus*, which have been reared from some living pupæ brought from Sierra Leone, and presented to the Society by the Hon. C. B. Mitford. These moths generally emerge in the early morning, and are fully developed in about two hours. If they are disturbed, they immediately drop down and feign death, and it will be easily understood that, with such long delicate tails, great care is required in killing and setting them.

The specimens of *Antheræa dione*, *Cyrtogone herilla*, and *Jana strigina* emerged from a collection of pupæ (also from Sierra Leone) deposited in the Insect-house by the Hon. Walter Rothschild.

The specimens of *Attacus lebeaui* were all reared from cocoons received in October to November 1894. The gentleman from whom I obtained them had a pairing of these insects and succeeded in rearing some of the larvæ. Of these he sent me four, in their fifth stage, and he informs me that the larvæ in the first three stages are black with yellow tubercles, in the fourth stage they are green, with the same stripes in the folds of the segments as in the fifth stage, but not quite so well marked, and have besides rows of dorsal and lateral tubercles of a reddish colour. They ate oak, berberis, and privet; but after the first stage fed entirely upon privet. Of these larvæ, I herewith exhibit a sketch, made just before they spun their cocoons. These cocoons, I may add, are much larger than those imported.

On the 30th of May, 1894, two Goliath Beetles (*Goliathus druryi*) were presented to the Society by Capt. G. L. Mitchell. They fed principally upon bananas. During life they were a great attraction to visitors. One died on the 24th July and the other on the 21st August, and both specimens were sent to the British Museum.

Of Orthoptera, a very curious and rare locust, *Thliboscelus camellifolia*, was sent home by Mr. Leslie Jeyes, from Manáos on the Amazons, where it is called the "Tanana." It arrived in the Gardens on the 21st of August, but, I am sorry to say, lived only six days. It was very weak on arrival and would not feed, although we got roses (its favourite food) for it. Of this species there is only one specimen in the British Museum. In a wild state Mr. Jeyes says "it sings or chirps through its wings." During life it was of a beautiful pale green colour, and this together with its peculiar shape gave it the appearance of some kind of green fruit. The sender says they are very difficult to obtain dead or alive; it is therefore probable that they are, on account of their shape and colour, not easy to see.

1. On the Brain of *Gulo*. By Frank E. Beddard, M.A., F.R.S., Prosector to the Society.

[Received January 21, 1895.]

One of the few important types of Carnivora the brain of which was not examined by Prof. Mivart[1] is the Glutton. As I have a well-preserved brain of this animal, it may be considered worth while to attempt to fill up this lacuna in our knowledge. We are not, however, absolutely ignorant of the characters of the convolutions of the cerebral hemispheres; for a cast of the inside of the skull has been described and figured by Gervais [1], whose paper is duly quoted by Mivart. It is, however, much more satisfactory to base a description upon the actual brain, which I now propose to do. I have compared the brain with actual specimens of the brains of *Nasua rufa*, *Meles taxus*, *Ictonyx zorilla*, *Galictis barbara*, and *Mustela foina*, which are among the Prosector's stores, besides, of course, with the descriptions and figures of Mivart and others.

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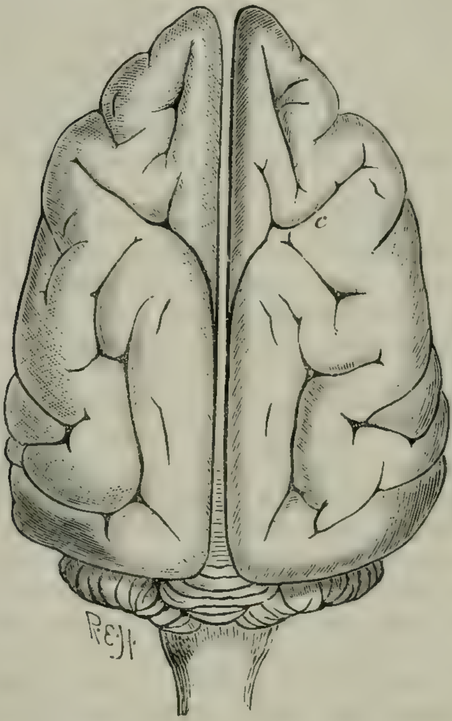
[1] "On the Cerebral Convolutions of the Carnivora," Journn. Linn. Soc. xix. p. 1.

Fig. 1.



Brain of *Gulo* (dorsal view).
c, crucial sulcus.

The outline of the brain of *Gulo* is, as will be seen from the accompanying drawing (fig. 1), remarkable. It is almost that of a square surmounted by a triangle, the line of division being the crucial sulcus. The cerebellum is largely hidden by the cerebral hemispheres, as is the case with some other Arctoidea, notably *Ictonyx*. *Mustela* stands at the opposite extremity, the cerebellum being in that animal but slightly overlapped.

The Sylvian fissure is long. As is generally the case with the

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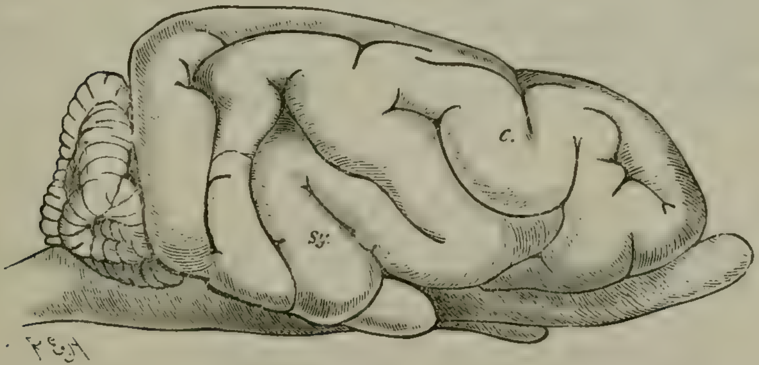
[1] "Mémoire sur les formes cérébrales propres aux Carnivores," Nouv. Arch. Mus. vi. p. 103.

Arctoidea, the anterior limb of the Sylvian gyrus is the longer. This is particularly marked above and leads toward the condition characteristic of *Meles* and *Nasua*, where the anterior limb of the Sylvian gyrus has the appearance of being tucked away in its upper part below the surface of the brain.

The parietal gyrus is connected by a bridging convolution with the sagittal gyrus. This is perfectly symmetrical on each side of the body and lies anteriorly on a level with the upper extremity of the Sylvian gyrus. At its extreme anterior end this gyrus becomes continuous with the Sylvian gyrus and, on one side, with the sagittal gyrus again.

The sagittal gyrus, as is the rule with the Arctoidea, is wide and complicated. That part of the gyrus which is at right angles with the rest, and reaches the margin of the pallium, is divided by a longitudinal furrow, of which there are only traces in *Galictis* and *Nasua* and no traces in *Meles*.

Fig. 2.



Brain of *Gulo* (side view).
Sy, Sylvian fissure; *c*, crucial sulcus.

I now come to the crucial sulcus (*c*), which is so important in the Carnivorous brain and especially in the Arctoid.

As in all Arctoidea, which are thus differentiated from the Ailuroidea, the crucial sulcus is situated comparatively far back. In *Gulo* the proportions of the lengths of the precrucial and postcrucial regions are 28 : 40. In *Meles* and *Taxus* they are more nearly equal, being 26 : 30. On the other hand, in *Galictis* they are 14 : 34. In *Gulo*, as in *Galictis*, the crucial sulci are nearly at right angles to the longitudinal axis of the brain. They do not reach the middle line, because in this region the hippocampal gyrus emerges from below on to the upper surface of the brain, and becomes continuous anteriorly with the sagittal gyrus. The margins of this eruptive portion of the hippocampal gyrus form with the crucial fissure a **Y**-shaped furrow on each side, the lines of the **Y** being widely divergent and forming with each other a very obtuse angle. The median portion thus enclosed has been termed by Dr. Mivart the "Ursine Lozenge." Dr. Mivart has justly laid stress upon the prevalence of this definite area in the Arctoid brain. He defines the Arctoid brain by the presence of the "Ursine Lozenge." The "Ursine Lozenge" of *Gulo* is most like that of *Galictis* among the types which I have examined, thus confirming the justice of its placing by Dr. Mivart[1] and others. The brains of these two animals are intermediate in character between those of *Nasua*, *Ictonyx*, and *Mustela* on the one hand, and those of *Helictis*, *Meles*, and *Mellivora* on the other. In the former group the lozenge is absent owing to the absence of a precrucial sulcus. I found traces of it in *Nasua*, which genus, it will be remembered, approaches *Galictis* in the presence of a postcrucial bridging convolution between the hippocampal and sagittal gyri.

Both Prof. Garrod[2] and Dr. Mivart were, in my opinion, wrong in regarding the brain of *Helictis*, first described by the former, as "exceptional." In *Meles taxus* we meet with precisely the same appearance of the hippocampal gyrus upon the upper surface of the brain. In these animals and, according to Mivart, in *Mellivora* there is an ursine lozenge formed which is completely closed in front. These therefore form the extreme term in a series which commences with the simpler brain of *Ictonyx*.

2. On the Brain in the Lemurs. By FRANK E. BEDDARD, M.A., F.R.S., Prosector to the Society.

[Received February 11, 1895.]

During the last few years I have accumulated a number of well-preserved Lemurs' brains extracted from specimens that have died in the Society's Gardens. I have thought that it might be useful to publish an illustrated account of some of these in order to supplement the existing knowledge of the Lemurine brain. The brains that I have examined myself are the following:—

Lemur mongoz,
Lemur brunneus,
Lemur anjuanensis,
Lemur coronatus,
Lemur albifrons,
Lemur rufipes,
Galago crassicaudatus,
Galago monteiri,
Cheirogaleus coquereli,
Loris gracilis,
Nycticebus tardigradus,
Perodicticus potto,

besides *Hapalemur griseus*, of whose brain I have recently published a description[3].

The literature referring to the Lemurine brain is not great.

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[1] "On the Anatomy, Classification, and Distribution of the Arctoidea," P. Z. S. 1885, p. 340.

[2] "Notes on the Anatomy of *Helictis subaurantiaca*," P. Z. S. 1879, p. 305.

[3] "Additional Notes upon *Hapalemur griseus*," P. Z. S. 1891, p. 456.

Nycticebus has been described and figured by Sir William Flower[1] and compared with *Lemur nigrifrons.* Burmeister[2] has dealt with the brain of *Tarsius* and given a figure thereof. Van der Hoeven and van Camper[3] have described but not figured the brain of the Potto. Owen has given[4] an illustrated account of the brain of *Chiromys.* Finally Milne-Edwards[5] has published figures and descriptions of the brain in *Avahis laniger* and other Indrisinæ; and Gervais[6] has written a more comprehensive paper than any of these, but his drawings are all from intra-cranial casts.

§ *The Brain of* Lemur.

Having had so many different species of *Lemur* for examination, I am able to say something as to the range of variation in the convolutions of this genus. This range is not large, but the bigger brains are on the whole more complex than the smaller. *Lemur anjuanensis* has the simplest brain of all the species I have examined. It is almost precisely like *L. nigrifrons* figured by Flower. In *Lemur albifrons* the *angular* and *infero-frontal* sulci very nearly join; on the lateral aspect of the brain two small sulci are visible, which are represented by the merest traces in *Lemur anjuanensis*; the first of these is in front of the Sylvian fissure, and runs obliquely upwards at right angles to the infero-frontal sulcus. The other fissure is a commencing division of the medio-temporal gyrus.

In *Lemur rufipes* the angular and infero-frontal fissures do not join; in the middle of the widest portion of what may perhaps be termed the sagittal gyrus is a deep, but very short furrow on each side. In this brain, as in those of all the species of the genus *Lemur*, the angular fissure has the form of an elongated **S**. The small perpendicular presylvian fissure has another in front of it. There are the same indications as in *Lemur albifrons* of a division of the medio-temporal lobe. *Lemur brunneus* hardly differs. On one side of the brain, however, there was a very considerable furrow half an inch long, dividing the upper part of the medio-temporal lobe.

In the brain of *Lemur mongoz* the angular and infero-frontal sulci are completely continuous. Otherwise there are no special points to be noted. Of *Lemur coronatus* I have examined two brains from two individuals, which, though of different sizes, were both females. In neither were the angular and infero-frontal sulci continuous. Both presylvian fissures were present, at least in the larger brain.

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[1] "On the Brain of the Javan Loris," Tr. Z. S. vol. v. p. 103.

[2] 'Beiträge zur näheren Kenntniss der Gattung *Tarsius*,' 1846.

[3] 'Ontleedkundig Onderzoek van den Potto van Bosman.'

[4] "On the Aye-aye," Tr. Z. S. vol. v. p. 68. See also Oudemans, Nat. Verh. Akad. Amsterdam, xxvii.

[5] Hist. Nat. de Madagascar, Mamm. p. 193.

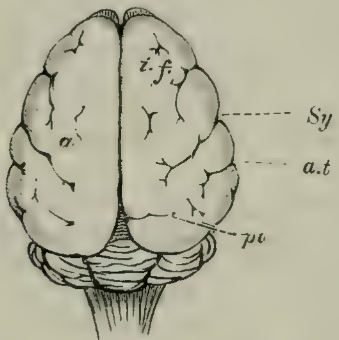
[6] "Mémoire sur les formes cérébrales propres à l'ordre des Lémures," J. Zool. i. p. 1.

§ *The Brain of* Nycticebus tardigradus. (Fig. 1.)

There appear to be more differences between the brain of this animal and that of its congener *Nycticebus javanicus* than between the different species of *Lemur* that I have examined.

To begin with, the brain is more rounded in front and the cerebellum is more fully exposed than is indicated in Sir W. Flower's figure[1] of *N. javanicus.* The angular fissure (*a*) is short, but instead of being straight it is crescentic in outline, the concavities facing each other. The two fissures look like a pair of brackets. The infero-frontal suture (*i.f.*) seems to be less conspicuous than in the other species of the genus, and on one side of the brain it ran back to join the curved (anteriorly convex) presylvian fissure, the homologue (?) of which latter in *N. javanicus* has a totally different direction. The parieto-occipital ("Simian") (*p.o.*) fissures are better developed than in *N. javanicus* and reach the intercerebral sulcus.

Fig. 1.



Brain of *Nycticebus tardigradus.*

a, angular fissure; *i.f.*, infero-frontal; *Sy.*, Sylvian fissure; *a.t.*, antero-temporal; *p.o.*, parieto-occipital.

§ *The Brain of* Perodicticus potto. (Fig. 2, p. 145.)

This brain differs from that of *Nycticebus.* The angular fissure (*a*) begins further back, well behind the extremities of the Sylvian and antero-temporal fissures, which are curved outwards as in the genus *Lemur*, but have not the peculiar S-shaped form that they have in that genus. The infero-frontal sutures, if I am right in so identifying those lettered *i.f.* in the drawing (fig. 2), have not the longitudinal direction that they have in other Lemurs. They run almost at right angles to the longitudinal axis of the brain, and are apparently very like those of *Callithrix* as figured by Sir Wm. Flower[2]. The angular fissure is prevented from joining the infero-frontal by a long straight presylvian fissure (*p.s.*), which runs up between them. The antero-temporal and Sylvian fissures join or nearly join above. There are faintly marked parieto-occipital fissures.

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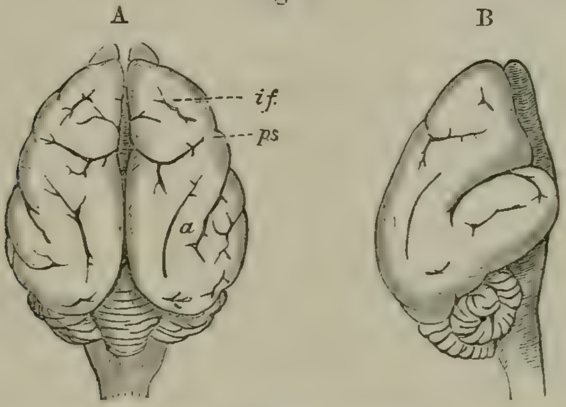
[1] *Loc. cit.* pl. 27. fig. 1.

[2] *Loc. cit.* pl. 27. fig. 11.

Fig. 2.

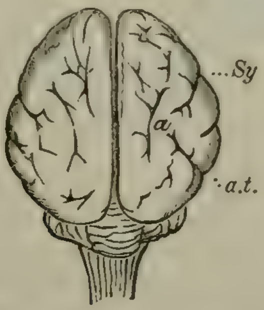


Brain of *Perodicticus potto*.
A, dorsal, B, ventral aspect; *p.s.*, presylvian fissure; other lettering as in fig. 1.

§ *The Brain of* Loris gracilis. (Fig. 3.)

The description of this little brain will not detain us long, as it is, with the exception of *Cheirogaleus*, the simplest form of Lemur's brain known to me. It is very rounded in form, a character which also distinguishes *Cheirogaleus*.

Fig. 3.



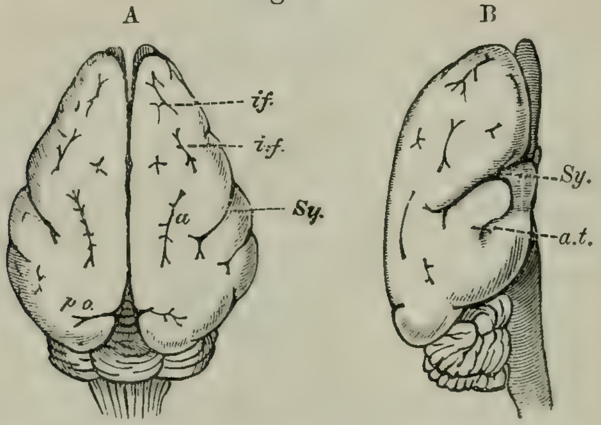
Brain of *Loris gracilis*.
Lettering as in fig. 1.

There are only three fissures plainly visible—the Sylvian, the angular, and the antero-temporal. The angular fissure is of moderate dimensions and is curved, the concavity being outwards. The other fissures call for no particular comment. On one side of the brain of one of the two specimens which I have is a very short parieto-occipital fissure. I would point out, in criticism of the use of intra-cranial casts, how totally my figure differs from that of Gervais[1], who represents the brain of this animal as comparatively complicated. As I have examined two brains which agree with each other, I think it may be fairly assumed that my description is accurate.

§ *The Brain of* Galago crassicaudatus. (Fig. 4.)

The brain of this Lemur differs in several particulars from the brains of other Lemurs which I have examined, though it is constructed upon the same general plan. The general outline of the brain is much as in the genus *Lemur*. The fissures are, on the whole, few, when the size of the brain is taken into consideration, but some of them are very deeply engraved. This is the case with the Sylvian and angular fissures, which are really the only well-marked ones.

Fig. 4.



Brain of *Galago crassicaudatus*. A, front, B, side view.

Lettering as in fig. 1.

The Sylvian fissure is not quite so long as it is in some other Lemurs. The angular fissure is not more than a quarter of an inch long, but it is very deep; it is slightly crescentic, the concavity embracing the extremity of the Sylvian fissure. The infero-frontal fissure on each side is represented by two detached portions, which are very short but fairly deep. They are in the same straight line, and the direction is obliquely inwards as in the genus *Lemur*. There is a small dent in the brain-substance just on a level with the hindermost extremity of the infero-frontal sulcus, in the middle of the widest part of the sagittal gyrus, which appears to correspond to a more strongly marked impression that I have already referred to as existing in a similar position in the genus *Lemur*. Below the infero-frontal sulci is a rather faintly marked furrow, longitudinal in direction, which I compare with the anterior of the two presylvian sulci found in many Lemurs. A very curious thing about the brain of *Galago* is the very faintly marked antero-temporal furrow. This is so characteristic a fissure of the Lemurine brain, and is the only fissure besides the Sylvian which is found in the otherwise smooth brain of *Tarsius* according to Burmeister's figures. We shall see, however, that it is also absent in *Cheirogaleus*. The parieto-occipital fissure is represented by two small grooves starting from the middle line. The brain of *G. monteiri* is not very different, but the dent lying in front of the angular sulcus is absent.

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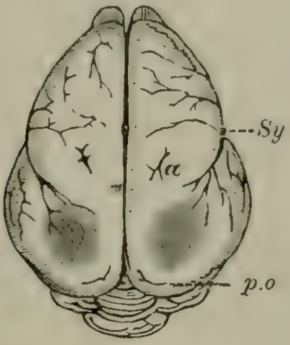
[1] *Loc. cit.* fig. 2, pl. ii.

§ *The Brain of* Cheirogaleus coquereli. (Fig. 5.)

This brain, as already mentioned, has a rounded form comparable to that of *Loris gracilis*, but it is much flatter, in fact markedly flat. On the upper surface, behind the Sylvian fissure, is a curious hollowing of the brain-surface, which is unlike anything that I have seen in any other Lemur. The cerebral hemispheres diverge from each other very slightly behind, the posterior margin of the hemispheres being almost straight.

Fig. 5.



Brain of *Cheirogaleus coquereli*.
Lettering as in fig. 1.

The brain is very slightly furrowed, not nearly so much even as in *Loris gracilis*, which is, moreover, a smaller brain. The only sulcus which is really conspicuous is the Sylvian. There is, as already mentioned, practically no trace of the antero-temporal. The angular fissures are, however, feebly represented by two short, shallow sulci, not more than $\frac{1}{8}$th of an inch in length. They are just in the middle of the brain.

§ *Mutual Affinities of the Genera of* Lemuroidea *as indicated by Brain-structure.*

There is no doubt that the structure of the brain of the Aye-aye, as figured by Owen, justifies the placing of that genus in a family by itself. Its most marked characters are (1) the production of a large semicircular sulcus by the fusion of the Sylvian with the parieto-occipital fissures[1]: (2) the length of the angular sulcus which blends in front with the infero-frontal and gives off two branches, one running downwards parallel with the Sylvian fissure, the other running inwards towards the middle line[2]. The former character is the most distinctive; for the long angular sulcus fused with the infero-frontal is met with in the *Lemurinæ*, and there are in them and in other Lemurs traces of the two branches in the presylvian fissure, and in the indentation to which I have referred as lying in the widest part of the sagittal gyrus. As to *Tarsius*, it has so smooth a brain that no inferences can be drawn.

There remains the family Lemuridæ, of which four subfamilies are commonly allowed, viz., *Lemurinæ, Indrisinæ, Galagininæ*, and *Lorisinæ.*

The first mentioned subfamily has a very uniform type of brain-structure. The differences between *Hapalemur* and *Lemur*, which I indicated some years since, are removed by the examination of a larger series of brains of Lemur. Indeed the only difference which I thought myself justified in pointing out was the continuity in *Hapalemur* of the angular and infero-frontal fissures; but, as I have mentioned in the present paper, the continuity is more marked in *Lemur mongoz.*

The *Lorisinæ*, on the other hand, do not form so natural an assemblage as do the *Lemurinæ.* It seems as if we had in this group the few remnants of a formerly much larger series—a suggestion which is borne out by their wide and scattered distribution. They all, however, agree to differ from the *Lemurinæ* in the shortness or even rudimentary character of the angular and infero-frontal fissures, which do not nearly meet, and in the presence of the parieto-occipital fissure near the middle line of the brain. These remarks, of course, hardly apply to the small and smooth brain of *Loris.*

The *Galagininæ* have as their most distinctive character the absence or feeble development of the antero-temporal fissure. They seem to be most like the *Lorisinæ* in other characters. They resemble them in the shortness of the angular fissure, and *Galago* has a further point of likeness to *Perodicticus* and *Nycticebus* in the cross-like parieto-occipital structure.

In all the *Indrisinæ* figured by Milne-Edwards this last mentioned fissure is well marked. But as I have not examined the brains of any of this group, I do not venture upon the expression of any opinion as to their affinities.

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[1] They are separated according to Oudemans.

[2] Or nearly; see Oudemans, *loc. cit.* pl. iii. figs. 12, 14.

3. On the Dates of the Parts of Siebold's 'Fauna Japonica' and Giebel's 'Allgemeine Zoologie' (first edition). By C. Davies Sherborn, F.Z.S., and F. A. Jentink, F.M.Z.S.

[Received January 31, 1895.]

The following results of an examination into the dates of publication of the separate portions of Siebold's 'Fauna Japonica' are offered for the assistance of zoologists. One of us has exhausted the means of discovery in England, the other has been able to examine the evidence at the place of publication; we feel, therefore, that the result may be relied upon:—

Mammalia.			
I.,	pp. 1–24.	**1842.**	Wiegm. Arch. 1843 (ii.), p. 11.
II., III.,	„ 25–40 and „ 1–26 (Mamm. marins).	**1844.**	„ 1845 (ii.), p. 7.
IV.,	„ 41–60.[1]	pls. **1845**; text ?	
Aves.			
I.,	„ 1–28.[2]	**1844.**	„ 1845 (ii.), p. 47.
II. & III.,	„ 29–60.	**1847.**	„ 1847 (ii.), p. 7.
IV.–VIII.,	„ 61–100.	**1848.**	„ 1849 (ii.), p. 38.
IX.–XI.,	„ 101–124.	**1849.**	„ 1850 (ii.), p. 49.
XII.,	„ 125–142.	**1850.**	„ 1851 (ii.), p. 42.
Chelonia.			
	pp. 1–80.	**1834.**	„ 1835 (ii.), p. 294, and 1836 (ii.), p. 259.
Ophidia.	pp. 81–96.	**1838.** (January.)	Wiegm. Arch. 1839 (ii.), p. 386, and 1841 (ii.), p. 113; see also p. 144, dated Jan. 1838, and Preface dated May 1838; and read 'Isis,' 1838, p. 778.
Sauria.	pp. 97–104.		
Batrachia.	pp. 105–144.		
Pisces.			
I.,	pp. 1–20.	**1842.**	Wiegm. Arch. 1843 (ii.), p. 103.
II.–IV.,	„ 21–72.	**1843.**	„ 1844 (ii.), p. 226.
V.–VI.,	„ 73–112.	**1844.**	„ 1845 (ii.), p. 190.
VII.–IX.,	„ 113–172.	**1845.**	„ 1846 (ii.), p. 399.
X.–XIV.,	„ 173–269.	**1846.**	„ 1847 (ii.), p. 346 and p. 364.
	270–324.	**1850.**	„ 1851 (ii.), p. 76.

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[1] All the plates were published by 1845, for they are quoted by H. Schinz, Syst. Verz. Syn. Mamm. vol. II.; but the first reference to pp. 41–60 of the text, that we can find, is C. G. Giebel, Allgem. Zool. 1853–55, first edition, of which the following is the proper collation:—pt. I., pp. 1–96; II., 192; III., 288; IV., 384 (**1853**): V., 480; VI., 576; VII., 672; VIII., 768 (**1854**); IX., 864; X., 960; XI., 1108 (**1855**).

[2] Wiegmann says *Pernis apivorus* closed this part, but G. R. Gray, Genera, i. p. 38, Sept. 1845, quotes p. 25, and therefore includes signature G in part 1.

Crustacea.

I.,	pp. 1–24.	**1833.**	Wiegm. Arch. 1842 (ii.), p. 317, note, and 1835 (i.), p. 5.
II.,	„ 25–64.	**1835.**	
III.,	„ 65–72.	**1837.**	
IV.,	„ 73–108.	**1839.**	
V.,	„ 109–164.	**1841.**	
VI.,	„ 165–196.	**1849.**	See signatures 7, 17, 19, 28, 42 & 50, and Wiegm. Arch. 1851 (ii.), p. 393.
VII.,	„ 197–244.	**1849.**	

Commentatio, pp. vii–xvi, April 1850; Præfatio, pp. iii–xxxi, 1849.

4. On the Pyrenean Newt, *Molge aspera*, Dugès. By Dr. J. de Bedriaga, C.M.Z.S.

[Received February 13, 1895.]

(Plates V. & VI.)

Synonymy.

Hemitriton asper, *cinereus*, *rugosus*, *punctulatus*, *bibroni*, Dugès, "Recherches Zoologiques sur les Urodèles de France," Ann. des Sc. Nat. 3e série, Zool. t. xvii. 1852, p. 253, pl. 1 B. figs. 1–3, 16–22.

Hemitriton asper, v. Bedriaga, "Beitr. z. Kenntniss d. Amphibien u. Reptilien d. Fauna v. Corsika," Arch. f. Naturgesch. xlix. Jahrg. 1 Bd., S. 124, Taf. iv. figs. 18–21, 23, 28, 31–37.

Triton pyrenæus, *rugosus*, *cinereus*, *repandus*, *bibroni*, *puncticulatus*, Duméril et Bibron, Erpétologie générale, t. ix. pp. 139, 150–154, Atlas, pl. 106. figs. 2, 3, pl. 102. fig. 4.

? *Euproctus rusconii*, part., Duméril et Bibron, ibid. p. 158.

Calotriton punctulatus, Gray, Proc. Zool. Soc. 1858, p. 139.

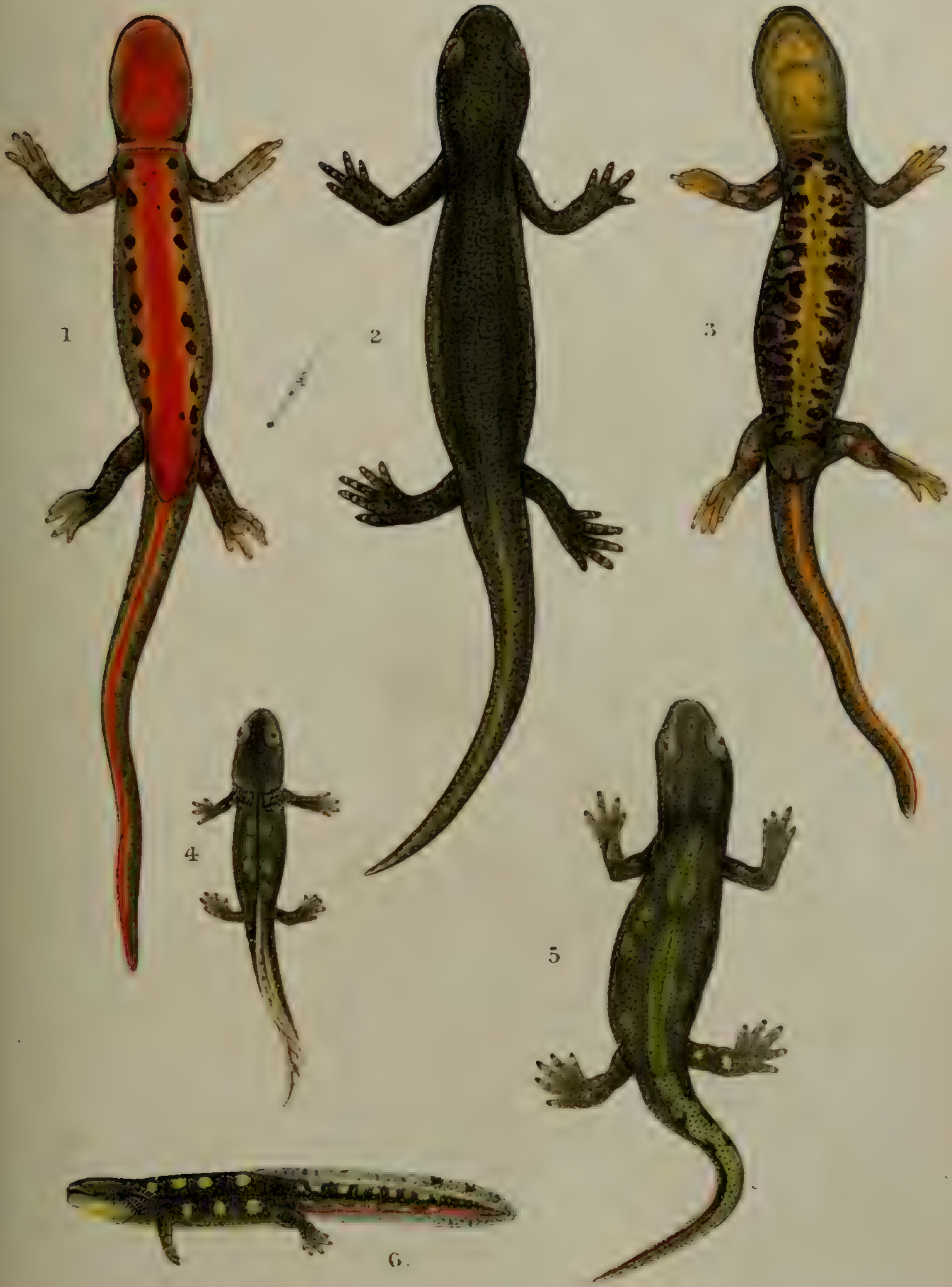
Triton platycephalus, part., Strauch, "Revision d. Salamandriden-Gattungen," Mém. Acad. Imp. Sc. de St. Pétersbourg, 7e série, t. xvi.; Schreiber, Herpetologia Europæa, S. 54 (Braunschweig, 1875).

Euproctus pyrenæus, Lataste, in Revue Internationale des Sciences, 1878, pp. 495, 496.

Molge aspera, Boulenger, Catalogue of the Batrachia Gradientia in the Collection of the British Museum, pp. 8, 24 (London 1882); v. Bedriaga, "Synopsis d. europ. Molge," Zoologischer Anzeiger, 1893, S. 214.

External Characters.

This species is allied to *Molge waltli*, having like it a very much developed cartilaginous internarial wall, a stout and clumsy body covered with rugous tubercular skin, free toes, and a crestless back. The head resembles that of the Italian *M. cristata* var. *platycephala*, but it is much more depressed; it is longer than broad, its greatest width at the posterior corners of the eyes. Snout rather

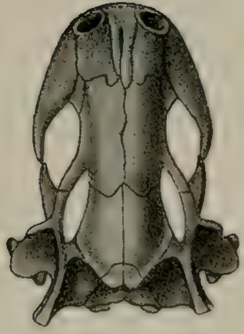


J. de Bedriaga pinxit.

Mintern Bros. Chromo lith.

MOLGE ASPERA

BRITISH MUSEUM
NATURAL HISTORY



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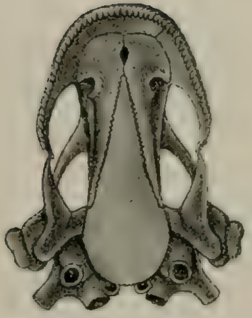

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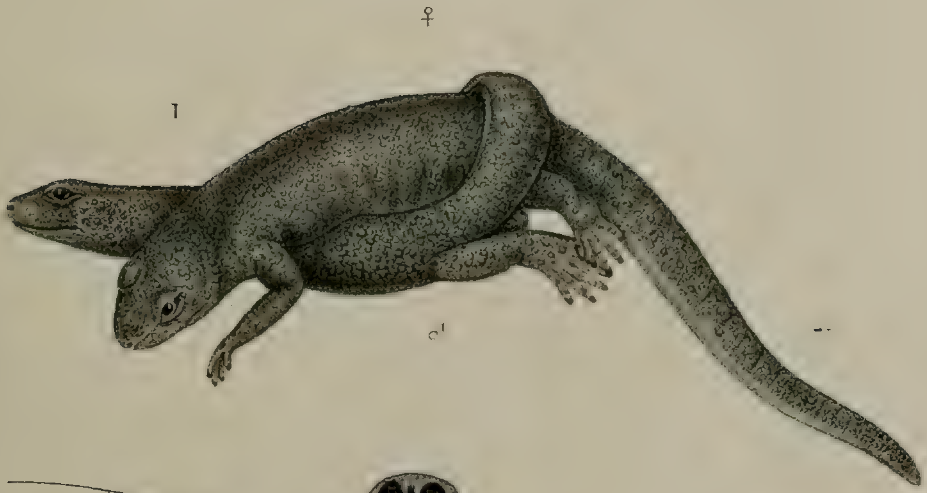

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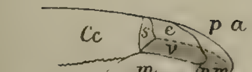

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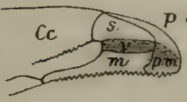

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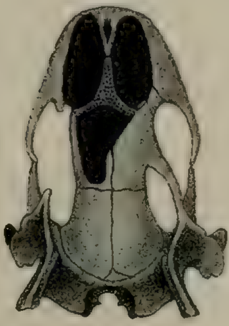

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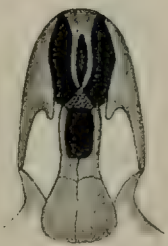

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J. de Bedriaga ad nat del.

Mintern Bros. lith.

MOLGE ASPERA

BRITISH MUSEUM
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NATURAL HISTORY.

elongate, slightly narrowed, rounded, blunt or distinctly truncate, projecting beyond the mouth. Canthus rostralis more or less distinct. Eyes lateral, moderately large, prominent on the upper surface of the head, which is flattened; the distance between them is rather less than between the nostrils and distinctly less than the distance from the latter to the eyes. The diameter of the eye, or rather the distance between anterior and posterior corner of the eye, is less than that between the eye and the nostril. The upper eyelid is narrower than the interpalpebral space. Nostrils rather large, close to the border of the snout, lateral, pierced just below the canthus rostralis, and therefore rather distant from the lip, though nearer to it than the eyes. Labial lobes well developed during the breeding-season, especially in males. Cleft of the mouth extending beyond the posterior corner of the eye. Tongue small, elliptical, slightly free along the sides. Palatine teeth in two slightly curved series, commencing on a line with the choanæ and in contact anteriorly, diverging gradually backwards and forming almost a Λ-shaped figure. Gular fold distinct. No parotoids.

Body stout, rounded or depressed (var. *rugosa*), longer in females than in males; no dorsal crest; longitudinal dorsal groove present or absent. Limbs moderate, clumsy; hind limbs stronger in the male, with a hardly visible fibulo-tarsal dilatation, when carried forwards along the body reaching to the middle of the space between hind and fore limbs or extending a little beyond; in females the hind limbs are always shorter than the above-mentioned length. Fore limbs, when brought forwards, reaching the anterior corner of the eye or slightly beyond, the latter being especially the case in females. Fingers and toes free, depressed and rather short: the fingers are somewhat longer and thinner in the female.

Anal lips forming in the male a nearly semiglobulous prominence like that of *M. cristata*, but with a longitudinal cleft not extending so far anteriorly, but occupying only the posterior half of the anal prominence. After the breeding-season the anal prominence sometimes assumes, especially in specimens from the Lac de Gaube, the shape of an obtuse cone. In females the anal prominence is pear-shaped or conical, with a short longitudinal cleft turned quite backwards; this cleft does not extend over the lower surface of the anal prominence. During the pairing and oviposition the summit of the cone is slightly directed downwards, but never to that extent which is the case in specimens preserved in alcohol; this cone has in living specimens never the length which it acquires as soon as the newt is put into spirit of wine.

Tail thick and rounded at the base, then becoming gradually compressed, ending in a more or less obtuse point, sharp-edged or keeled above in its posterior part: beneath, a more or less sharp edge is seen sometimes only at the very end of the tail. The tail is low and as long as head and body or longer in the female; higher, thicker, and shorter than head and body in the male. In the former the length of the hind limb is generally contained thrice in the length of the tail; in the latter the hind limb measures a little less.

Upper surface generally minutely granulate, with numerous linear grooves and more or less distinct and more or less numerous warts furnished with a dark granular, conical or spine-shaped horny tubercle. These warts are mostly developed along the sides of the body and head, along the limbs and on the tail; they are also very frequent on the upper part of the head and on the back, rather seldom and scarce on the abdomen and on the lower surface of the limbs. In specimens from Lake Gaube, which I consider to belong to var. *rugosa*, the skin is roughly tuberculous, especially on the base of the tail; the warts are here decidedly conical with spiny tubercles. Very seldom, and, as it seems, only in females during the breeding-season, the skin appears nearly smooth. No distinct carpal or tarsal tubercles.

Coloration. (Plate V. figs. 1, 2, 3, 5.)

The upper parts are greyish, brownish grey, or olive-grey, uniform or with yellow or yellowish spots. The shade varies in the course of the year and in different individuals at the same period: however, the colours get merely darker or lighter, and the predominant one seems to be as a rule grey, varying from the lightest ash-grey to blackish grey. The yellow-spotted individuals are less abundant than the uniform ones, and the bright lemon-yellow spots are seldom seen in adults; the yellow is generally very pale or intermixed with grey. These spots are very variable in size, shape, and disposition; they are either small, round, indistinct and scattered along the sides of the body, or larger, irregular, and disposed quite asymmetrically on the back; very often they are more or less confluent and form a broad vertebral band, which appears sometimes interrupted in different places. In cases when it is absent, the median dorsal line is mostly marked, being generally of a light brownish tint. The yellow spots on the tail are frequently much more marked than those over the body; they are round or rhomboidal, and placed along the upper portion of the tail, or confluent with a yellow band or yellow line which extends over the middle of the tail. This line is nearly always present even in the uniformly blackish specimens, though it is rather seldom of a light and bright colour, but brownish yellow. The dark granules which crown the warts and the spine-shaped tubercles are more distinct in lighter individuals, and especially on the sides of the head, body, and tail, where they are surrounded by a yellowish circle or even placed on yellowish or whitish warts. These light warts may appear in great number on the sides of the body and on the lower portion of the tail; the limbs also possess some. Towards the lower part of the sides of the body, as well as on the sides of the belly, the greyish ground is generally powdered with yellow and spotted with small round or angular and irregularly shaped dark spots: these spots seem never to be absent along the border of the dark area of the sides of the belly, and are partly placed on the grey ground-colour and partly on the bright-coloured median area of the belly. The latter varies in its width; it is pale yellow, yellow with or without traces of orange and pink, orange or red. Generally the whole middle portion of this area is entirely immaculate; sometimes with very few spots, and these distinct, wide apart, scattered, and entirely dark round ones, just as if they had been accidentally misplaced. The throat is immaculate or indistinctly dotted with grey; its ground-colour is similar to that of the belly, but it has never the same rich tint, sometimes so beautiful; the lower edge of the tail on the contrary may be even more brightly coloured than the belly. When collecting these newts, I was quite struck by an orange or red line underneath the tail which the animal seemed intentionally to exhibit, and which looked just like the antenna of a boiled crawfish. The anal prominence appears also often orange or reddish, and these colours can extend over the lower surface of the limbs. The inner fingers and toes are always lighter than the outer ones and as a rule yellowish; palms and soles are yellowish or partly yellow and partly, on their external portion, grey. The transverse dark stripes on the fingers and toes are more or less distinct. The tips of the fingers and toes are generally dark.

Pupil oval, with a pale gold margin interrupted below in the middle. Iris pale golden, strongly spotted with light and dark brown.

Variation in Colour.

The ground-colour and the markings vary to a certain extent in *M. aspera*, but these variations are mostly either merely individual or due to sexual selection. In other cases light and bright colours appear temporarily when the newt lives in water and disappear as soon as it goes on land. Different combinations of colours and shades as well as markings are also in so far temporary as they vanish with the growth of the newt. As regards the colours of the upper surfaces of the adult, both sexes are alike; the diverse modes of life affect them only to a certain extent, for we know that this species is brightly coloured in summer and that it gets a duller colouring in winter. The modifications of colours of the lower surfaces are doubtless connected with the sexual functions, and, strange to say, the greater brightness of colour is shown by the females, whilst in all other species we find in the female plain colours, whilst the males acquire a more intense and brilliant coloration.

As a rule the colours of both sexes are alike in the young, but the older the newts get the more the colouring of their lower surfaces is differentiated. The young ones are generally light grey and more or less spotted with yellow or striped; their belly is pale orange. With the growth of the individual appears a tendency to deeper and more intense colouring of its upper surfaces, and the yellow markings very often disappear altogether or become comparatively indistinct, whilst the lower surfaces generally turn paler in the male and retain the primitive tint in the female, or acquire in the latter more and more intensity.

The sexual difference in the colour of the belly, throat, and edge of the tail is almost constant, although it is not so striking during the terrestrial existence of this newt.

Var. *rugosa.*

My friend Mr. G. A. Boulenger refers *Hemitriton* vel *Triton cinereus*, *rugosus*, *bibroni*, *puncticulatus*, Dugès, Duméril & Bibron, *Hemitriton asper*, Dugès, *Triton repandus* and *Tr. pyrenæus*, Duméril & Bibron, to the synonymy of *Molge aspera*, and in fact the descriptions given by the French authors are so superficial and unsatisfactory that they lead merely to confusion. Besides, the above-named authors were neither well informed about the localities in which their indifferently preserved specimens were captured, nor did they take the trouble to discriminate the sexes. Mr. Boulenger was therefore perfectly right in referring all those numerous species to *M. aspera*, Dugès. Nevertheless one of them, the *Hemitriton* or *Triton rugosus*, may be considered as a variety. At least I believe that the specimens of *M. aspera* which I collected in the Lac de Gaube and in the river Gave are different to a certain extent from those I found in the Lac d'Oncet. Those lakes (and the same may be said of the greater number of lakes in the Pyrenean mountains) are perfectly isolated one from the other, and it is therefore hardly possible that the newts of one of the lakes ever mix with those of the neighbourhood.

The principal characters of the rugous variety of *M. aspera* are as follows:—

The physiognomy and coloration resemble those of *M. waltli*. Total length 150 mm. This newt is therefore somewhat larger than the type. Head large and much depressed; snout distinctly truncate. Skin strongly tuberculate above, especially along the sides of the head, body, and tail, where regular spines are to be found. The upper surfaces are light or dirty grey with a more or less pronounced brown tint, spotted with dark olive-brown or blackish. These spots are (especially when small and round) very distinct upon the lower parts of the sides of the body and towards the belly. In individuals with yellow markings on the back and tail these spots concentrate near the markings and generally form their dark margins. The above-mentioned warts are yellowish or dirty white, with dark horny granules or spines in the middle. The tail seems to be always a little lighter than the body, mostly greyish with small dark spots and a brownish-yellow line along the upper caudal edge, which is very often interrupted by dark brown or blackish specks. Sometimes more or less confluent yellow spots appear on the upper part of the tail. Throat and median region of belly yellowish, with rather numerous small dark grey or blackish spots, especially towards the posterior part of the belly in the male, or orange without or with very few blackish round spots. Lower edge of the tail yellowish in the male, orange or reddish in the female.

Measurements (typical form).

	♂. millim.	♀. millim.
Total length	113	128
Length of head	18	16
Breadth of head	13	11
From end of snout to anus	61	61
Length of tail	52	67
Depth of tail	7	6
Fore limb	18	17¾
Hind limb	19	18

Sexual Characters.

Male.—Tail shorter than head and body. Cloacal lips grey, strongly swollen and forming a subglobulous prominence; the longitudinal cleft extending over its posterior part[1]. Belly with a narrow yellow, rarely orange median zone, generally spotted with black or dark grey, especially on the hinder portion.

Female.—Tail as long or longer than head and body. Anal prominence orange, conical or pear-shaped, much produced, directed backwards, with a short longitudinal or rather vertical cleft on the summit of the cone, looking entirely backwards. Belly with a wide orange or reddish median area, which is generally immaculate.

Osteological Characters.

The two series of palatine teeth commence on a line with the choanæ (Plate VI. fig. 3).

The fronto-temporal arch is bony (fig. 2).

The quadrate projects sidewards and looks at the same time rather backwards than forwards.

The crista ossis vomero-palatini is hardly developed.

The septum nasi is formed by a single cartilaginous plate. [In all European newts with the exception of *Molge aspera* and *M. waltli* there is an almost entirely osseous and double septum nasi with but a small terminal cartilaginous portion, which separates it from the cartilaginous ethmoidal plate. It is formed by the well-developed ascending process of the premaxillary and the crests of the vomero-palatines which rise vertically. The almost wholly unossified septum nasi of *M. aspera* resembles that of *M. waltli*. It is merely a single, well-developed, thickish, cartilaginous wall, which extends beyond the opening between the vomero-palatines for the duct of the so-called "intermaxillary gland" and keeps the nasal cavities apart. Its posterior portion is grafted on the substance of the lamina cribrosa, anteriorly it meets the short inner vertical portion of the processus ascendentes of the premaxillary. The sectional view of the anterior part of the skull (Plate VI. fig. 5) and the upper view of the partly dissected skull (fig. 6) show the curious structure of the nasal cavity of *M. aspera*. I append two other views—fig. 4 and fig. 7—of the skull of *M. rusconii*, for the purpose of exhibiting the difference in the structure of the nasal cavity. *M. rusconii* possesses a strong double and ossified septum nasi.]

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[1] The anal prominence appears sometimes in the males of the rugous variety very obtusely conical in winter.

Larva. (Plate V. figs. 4 & 6.)

The head is rather large, longer than broad, and more or less distinct from the neck; the upper surface is flat. The snout is slightly depressed and rounded; it is always longer, narrower, and lower in females than in males. Nostrils very near the border of the snout; the distance between the nostril and the lip somewhat less than one-fifth of the distance between the nostril and the eye; the internarial space is a little broader than the interpalpebral breadth. Eye moderate, oval, lateral, moderately prominent; its distance from the nostril equalling (♂) or exceeding (♀) the interpalpebral width, and its distance from the lip is considerably greater than the vertical diameter of the eye. The longitudinal diameter of the eye is shorter than its distance from the nostril and also shorter than the internarial width, the breadth of the upper eyelid slightly exceeding the half of the interorbital space. The pupil is round. The cleft of the mouth extends to the vertical of the posterior angles of the eyes. Labial lobes moderately developed. The space between the longest gills is considerably longer than the upper part of the arm.

Body robust, rather short, and nearly round in males; more slender, moderately elongate, with flattened lower surface, in females. The distance between fore and hind limb is at least twice as great as the width of the head. Caudal crest extending but very slightly upon the back; it occupies hardly one-third the length of the body. Longitudinal groove along the sides very indistinct; eleven or thirteen costal grooves between axilla and groin, ten transverse grooves upon the belly. Anal region in young specimens hardly swollen. The limbs, especially the hind ones, are short and thick in the male, a little thinner in the female; the fore limb when stretched forwards reaching the anterior corner of the eye in the male, or slightly beyond in the female; the hind limb being carried forwards equals the half of the length of the distance between fore and hind limbs. Fingers and toes short, rather thick, ending in a point; the third finger longer than the second, which is longer than the fourth and first; the first is somewhat shorter than the fourth; the middle toe is the longest, the fourth toe is longer than the second, which is in its turn much longer than the first and fifth; the latter is a little longer than the first. The tips are blackish brown. Tail measuring about the length of head and body, thicker at the base in the male, becoming gradually compressed, furnished with a low crest, ending in an obtuse point or rather broadly rounded at its end; its lower crest is generally slightly deeper than the upper one; both crests with nearly straight and parallel edges.

Upper parts grey, olive shaded, or brownish grey, powdered with yellow. Back and sides of the body with or without more or less distinct yellow or greyish-yellow spots; similar spots are generally scattered on the greyish or brownish muscular region of the tail and followed by a series of dark spots; some specimens, however, have an almost immaculate tail. Upper part of the muscular region of the tail very often with a yellow margin, the lower edge very often, and mostly in females, orange. The rather thickish caudal crest is yellowish grey, or grey spotted and punctulated with brown or greyish brown, but always less abundantly on the lower and anterior portion. Throat nearly transparent, pale yellow; belly yellow in the middle, yellowish grey on the sides—immaculate in females, dotted with brownish grey in males. The branchiæ are grey or brownish above, reddish beneath. Iris dark brown, pupil with a golden margin.

In deep water the larva acquires a very dark colouring and is almost immaculate.

	♂. millim.	♀. millim.
Total length	58½	56
Length of head	9	8½
Breadth of head	6½	5–6
From end of snout to anus	28½	28
Fore limb	9½	8½
Hind limb	9	8½
Length of tail	30	28
Depth of tail	6½	5½

Geographical Distribution.

M. aspera was first noticed as a Pyrenean species by Dugès, Duméril and Bibron from Eaux-Bonnes, later on by Philippe from the Lac Bleu (*Triton glacialis*, in Séance de l'Acad. de Montpellier, 1847, p. 20), and more recently from the Lac d'Oncet, Pic du Midi (F. Lataste, *l. c.*), from Cauterets (Valery Mayet), and from the Lac de Gaube (F. Müller). This newt occurs also but rather scarcely in the Lac d'Oo and near the Pont d'Espagne in the river Gave. In North Spain it has been recorded from different points, such as La Junquera, Cerdania, Panticosa (Boscá, in Bull. Soc. Zool. de France, t. v. p. 247).

Habits.

The distribution of *M. aspera* in the Pyrenean region is not as yet exactly ascertained. We only know that this species occurs in lakes in the high mountains, and that it is common enough in several of the above-mentioned, whilst in others in their neighbourhood which are not supplied during the whole summer by fresh glacier water it is not found. The Lac d'Oncet, where it is perhaps more abundant than elsewhere, lies at an elevation of about 2300 metres; it is free from ice and snow only during a couple of months in the year, and sometimes the summer life of *M. aspera* is even limited to seven or eight weeks; nevertheless those conditions of existence seem to suit that newt, as it is seldom found in places of a low elevation or on level country, and if by chance this does occur, never in numbers. The specimens captured at Pau and at Cauterets certainly did not intentionally immigrate there, but were dragged there with the mountain-currents; even the individuals which I have collected higher up in the Gave were doubtless also such forced travellers.

Amongst other conditions required for the well-being of this newt, the quality of the ground of the lakes seems to be an important one; as it is found only in lakes with stony and rocky bottom. It does not survive a prolonged immersion in water; and, as it swims slowly, I presume that it lives only in places where the water is not deep. Fishermen whom I questioned assured me that in the Lac de Gaube their nets never brought *M. aspera* when thrown deep down, but another much longer newt! The localities preferred by *M. aspera* in the lakes which I have visited are the small creeks near the influx and the outflow of the water, and often enough I discovered half a dozen specimens sitting close together in the most singular attitudes, under a large stone in the water. As this newt moves only when in search of food, or when it feels the want of a breath of fresh air and has to swim towards the surface of the water to get it, it is only now and then seen, the rest of the time it hides itself. Large stones, even blocks, have sometimes to be lifted in order to get at it, and even then promptness is required to seize it, so to say by surprise, as soon as it is discovered, otherwise it makes use of the smallest rift to escape and hide itself under the rubble-stones which form real labyrinths in the Pyrenean lakes.

The motions of the adult *M. aspera* are so slow, the bright-coloured stripe along the lower edge of the tail, and especially the yellow spots some individuals show on their upper surfaces, are so striking that the stony ground with its numerous lurking holes is a great protection for this newt, though it seems that in some lakes, like the Lac d'Oncet for instance, their only enemies are the naturalists. In the Lac Bleu and in the Lac de Gaube, where *M. aspera* is far from being abundant, quantities of trout are found, and it is more than probable that the fish persecute and destroy the newt, and not *vice versa* as the natives presume. The few Pyrenean inhabitants who know of the existence of *M. aspera* in their lakes spread the worst reputation about this innocent creature, and I met with athletic shepherds accustomed to deal with wolves, bears, and vipers who trembled at the very sight of *M. aspera*, and of course they were not to be persuaded into helping me to collect them, especially when, after having assured them that these animals neither "sting" nor bite, I was bitten by one in their presence.

M. aspera bite not only when they are caught and squeezed but also amongst themselves; a phlegmatic female will for instance bite a male when she is annoyed by his courtship. The male of *M. rusconii* also bites, not in self-defence, but in order to seize a female and prevent her from escaping when pairing. *M. aspera*, on the contrary, does not make use of its jaws during the act of fecundation; the male seizes the female merely with the muscular tail, which he raises and twists round the hind part of the female's body. The attempts of the female to escape are generally in vain; each of her movements forwards in order to slip out of the noose formed by the tail of the male induces the latter to press her tighter, and as soon as she is subdued the male begins to give her other proofs of his amorous disposition by caressing her anal prominence with his toes. The male lies during the sexual embrace under the female, their heads are turned in the same direction and the anus of the male is just under that of the female; the latter can therefore, as soon as she is disposed to be fecundated, gather the spermatophore immediately after the emission from the cloaca of the male and, so to say, suck it in the cloaca without separating from the male.

Fecundation and oviposition very often take place at the same time; the male probably exercises a pressure upon the oviducts, forcing them to discharge their contents and thus acts as a midwife. The attitude of the couple during their amorous evolutions is shown in fig. 1 (Plate VI.). The amplexus may last for hours and sometimes degenerates into a torture for the female. The latter is a captive in the most awkward position so long as it pleases the male; the latter rules all the movements of the couple, and the female often is in agony when she feels the want of a breath of air, and has to wait until the male drags her to the surface of the water. Often the male fails in his attempts to embrace the female, and instead of twisting his tail round her abdomen he girds higher up round her neck: the female then becomes suffocated after a short while.

M. aspera has been observed pairing towards the end of June. Last year when I visited the Pyrenees the beginning of the summer was winter-like, the ice melted in the lakes very late, in some of them at the end of July; newts appeared about the 22nd of July, and I found them pairing or depositing their eggs in the last days of July. I caught at the same time several full-grown larvæ which had of course hibernated in the lake. These larvæ were still more difficult to get at than the adult specimens, as they are very quick in their movements and very shy. The amorous evolutions of *M. aspera* can be observed nearly at every season of the year in captivity; very often it is sufficient to put a well-fed couple under the water-pipe and let the water run over the animals, and the male seizes the female immediately with his tail.

Specimens of *M. aspera* are rather easily kept in captivity during their sojourn in water, but as soon as they go on land great care is needed to prevent their ailing and dying. Usually after they have lived for some time in the terrarium they get dark spots, especially on the sides of the body; those spots enlarge, just as oil-spots would do, until the skin perforates. Left to themselves, without care, the sickly specimens are sure to die; properly treated, they recover as a rule, even those whose ribs are piercing through the wound. The treatment of this disease is very simple, and I shall mention it, as it is very common especially amongst the high mountain newts, such as *M. montana* and *M. rusconii*, and also amongst *M. waltli*; it consists merely in keeping the invalids in running water; cold water which is often changed will also do. The vessel in which they are kept must be thoroughly clean and contain nothing but water; the food should consist only of earth-worms, and the remains of the meal must be taken out. *M. aspera* feeds upon earth- and meal-worms, flies and aquatic plants; in captivity it takes rough meat willingly, but it ought not to be fed exclusively on meat.

EXPLANATION OF THE PLATES.

PLATE V.

Fig. 1. *Molge aspera* ♀, typical form. Lower view.
Figs. 2, 3. *M. aspera* ♂, typical form. Upper and lower view.
Fig. 4. Larva of *M. aspera*, full-grown specimen, natural size.
Fig. 5. A young male of *M. aspera*.
Fig. 6. Larva of *M. aspera*. Side view.

PLATE VI.

Fig. 1. *M. aspera*, ♂ and ♀ in copulâ.

Magnified figures.

Figs. 2 and 3. Skull of *M. aspera*. Upper and lower view.

Fig. 4. Longitudinal vertical section through the nasal cavity of *M. rusconii*. Schematic. *Cc.* Cavum cranii. *M.* Maxilla. *pm.* Premaxilla. *pa.* Processus ascendens of the premaxillary. *v.* Horizontal portion of the vomero-palatine reaching the horizontal part of the premaxillary (*pm*) and roofing the cavum nasi. *C.* Crista ossis vomero-palatini uniting with the ascending process (*pa*) of the premaxillary (*pm*) and forming the osseous internasal wall. S. Rudimentary, cartilaginous, terminal septal portion.

Fig. 5. Longitudinal vertical section through the nasal cavity of *M. aspera*. Schematic. *Cc.* Cavum cranii. *M.* Maxilla. *pm.* Premaxilla. *pa.* Processus ascendens of the premaxillary. *v.* Horizontal portion of the vomero-palatine reaching the horizontal portion of the premaxillary (*pm*) and forming the nasal roof. *S.* Internasal cartilaginous septum meeting in front the processus ascendens (*pa*) of the premaxillary (*pm*).

Fig. 6. Partly dissected skull of *M. aspera*. This figure shows the cavum nasi and the anterior part of the cavity of the brain; the nasals, prefrontals, and frontals are cut away; the terminal part of the processus ascendentes, which is seen in fig. 3 partly overlapping the suture of the frontals, is also removed. A transverse cartilaginous plate separates the cavum cranii from the nasal cavities. In front of it a longitudinal median wall (septum cartilagineum) keeps the nasal

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cavities apart. The processus ascendentes of the premaxillary are comparatively very short, the crested part of the vomero-palatines hardly developed.

Fig. 7. Partly dissected skull of *M. rusconii.* The nasals, prefrontals, and frontals are cut away. A transverse cartilaginous ethmoidal plate separates the cavum cranii from the nasal cavities, which are separated longitudinally by a double ossified septum; the septum nearly reaches the lamina cribrosa. Here in *M. rusconii* there is only a small rudimentary cartilaginous septal portion grafting itself upon the ethmoidal plate.

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The 'Proceedings' are issued in *four* parts, as follows:—

Part I. containing papers read in January and February, on June 1st.
II. ,, ,, ,, March and April, on August 1st.
III. ,, ,, ,, May and June, on October 1st.
IV. ,, ,, ,, November and December, on April 1st.

AUG 1895

PROCEEDINGS

OF THE

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OF THE

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OF LONDON,

FOR THE YEAR

1895.

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Fig. 7. Partly dissected skull of *M. rusconii*. The nasals, prefrontals, and frontals are cut away. A transverse cartilaginous ethmoidal plate separates the cavum cranii from the nasal cavities, which are separated longitudinally by a double ossified septum; the septum nearly reaches the lamina cribrosa. Here in *M. rusconii* there is only a small rudimentary cartilaginous septal portion grafting itself upon the ethmoidal plate.

March 5, 1895.

Sir W. H. Flower, K.C.B., LL.D., F.R.S., President,
in the Chair.

The Assistant Secretary read the following report on the additions to the Society's Menagerie during the month of February 1895:—

The total number of registered additions to the Society's Menagerie during the month of February was 36, of which 18 were by presentation, 3 by birth, 7 by purchase, and 8 were received on deposit. The total number of departures during the same period by death and removals was 124.

Amongst the additions attention may be called to a fine female Giraffe, which was received from South Africa. This is believed to be the first example of the large dark-blotched race ever seen in Europe, the Giraffes previously exhibited having belonged to the smaller and paler form found in Northern Africa.

The Giraffe, which was purchased of Mr. C. Reiche for £500, is said to be the survivor of six, captured on the Sabi River, in Portuguese territory, and brought down to Pretoria. The remainder were lost by death and disease. The present animal was conveyed to Delagoa Bay, and shipped to Southampton in the S.S. 'Greek.'

The Society has also purchased of Mr. Reiche a pair of Sable Antelopes (*Hippotragus niger*) and a pair of Brindled Gnus (*Connochætes taurina*), all in excellent condition.

The Assistant Secretary exhibited on behalf of Mr. W. Halsey, of the Hudson's Bay Company, two Marten's skins which had been received from districts widely apart. The peculiarity in these skins consisted in the fact that one of the fore legs was deficient in both of them.

The following papers were read :—

1. On the Hyoid Bone of certain Parrots.
By St. George Mivart, F.R.S.

[Received March 4, 1895.]

Distinctive structural characters are so much needed for the classification of birds, that I think the following descriptions and illustrations of some skeletal structures, which, so far as I know, are now described and figured for the first time, will not be unwelcome to Ornithologists, if not to other naturalists also.

The structure of the hyoid in certain birds was described as long ago as 1835 by G. L. Duvernoy (Mém. de la Société d'Hist. nat. de Strasbourg, tome ii.), who figured those of *Ara ararauna* and *Coracopsis vasa*. In 1858 C. Giebel (Zeitsch. gesammt. Naturwiss. Band xi. pp. 42 & 43, Taf. v. & vi. figs. 35–41) gave representations and descriptions of the hyoid of the following species as named by him:—*Psittacus rufirostris* (fig. 35), *P. erithacus* (fig. 36), *P. ochrocephalus* (fig. 37), *P. leucocephalus* (fig. 38), *P. menstruus* (fig. 39), *P. sinensis* (fig. 40), and *P. cristatus* (fig. 41). Dr. Gadow (1891) has also described and figured (Bronn's Thierreich, Band vi. Abtheilung iv., Anatomischer Theil, pp. 298, 299, and 302, plate xxx. fig. 20) the hyoid of a species of *Ara*.

Having lately directed my attention to the skeleton of the Lories, I was very desirous to examine the hyoid in species of that family, in order to compare them with that of *Psittacus erithacus*, taking the latter as my type of Parrot-structure.

Through the kindness of our Prosector, Professor Beddard, F.R.S., I have received for examination the hyoid bones of *Psittacus erithacus*, *Lorius domicella*, *L. flavopalliatus*, *Eos reticulata*, *E. indica*, *Trichoglossus ornatus*, and *Stringops habroptilus*.

So far as I have been able to ascertain, the whole order PSITTACI is distinguished from every other order of birds by the shape of its hyoid. The characters which, when taken together, seem distinctive are:—

(1) *Basihyal* much broadened posteriorly.

(2) *Basihyal* developing on either side a forwardly and upwardly directed process, which I propose to distinguish as a *parahyal* process.

(3) An *os entoglossum* in the form of a single broad bone with a considerable central foramen or, much more commonly, in the form of two lateral parts, entoglossals, medianly united in front by cartilage and leaving a vacant space between this and their attachment behind to the basihyal.

The real nature of these entoglossals (as I propose to call them) is not evident to me. Owen writes[1] of the ceratohyal as being

---

[1] Anat. of Vertebrates, vol. ii. p. 57.

"always short, usually extending forwards from its attachment as well as backward," adding that "the forward production often unites with its fellow, so as to form the basal part of the direct support of the tongue."

Each entoglossal does project both more or less backwards as well as forwards from its place of attachment to the basihyal, and this may indicate that it includes a ceratohyal element, but it must surely represent the glossohyal also. This question I will not, however, now attempt to determine.

That the Parrots should have a tongue-bone of exceptional form is, of course, only what was to be expected from the exceptional form of their tongue as a whole.

I will now first describe the hyoid of *Psittacus erithacus* as a type, then those of the three genera of Lories and that of the genus *Stringops.*

PSITTACUS ERITHACUS. (Fig. 1, p. 164.)

The *basihyal* is narrow for rather more than its anterior half, expanding slightly both laterally and vertically towards its extreme anterior end, where there is a saddle-shaped surface (for the entoglossum) convex transversely and concave vertically. Its ventral lip projects forwards much more than does its dorsal lip. On the dorsum of the basihyal at its anterior end is a slight, though marked, concavity (*c*). The posterior part of the basihyal expands into a subquadrate plate, the centre of which is traversed by a strong antero-posterior ridge continuous with the transversely convex upper surface of the narrow anterior portion of the bone. From each antero-external angle of the quadrate plate of the basihyal a marked parahyal process (*p*) extends forwards, upwards, and slightly outwards, then narrowing to a bluntish point which inclines inwards as well as upwards, the whole parahyal process on each side being more or less curved.

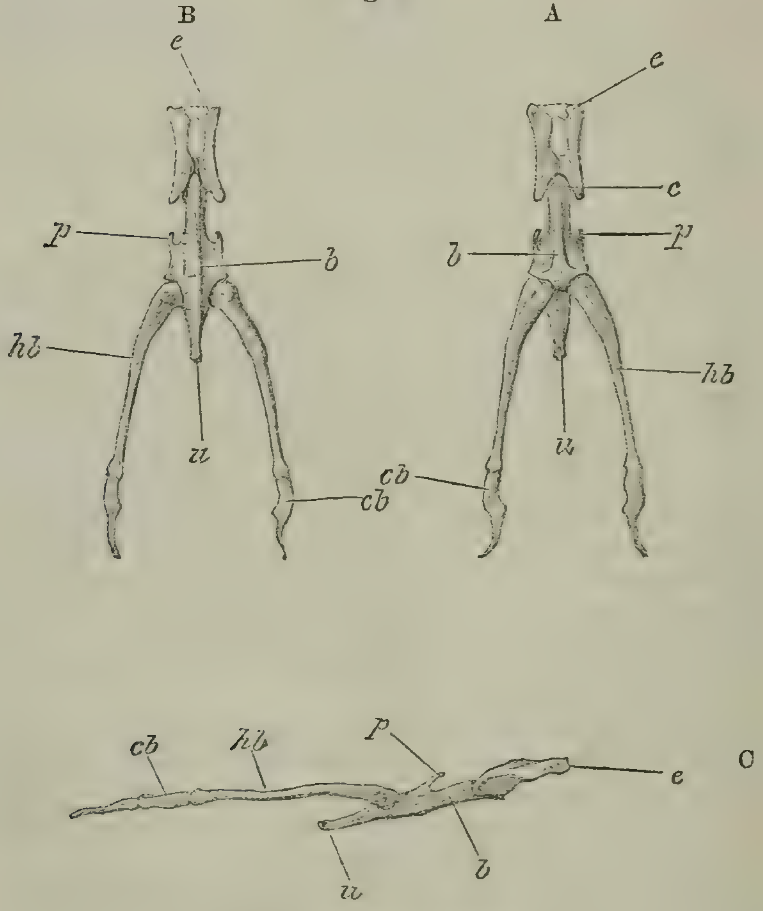
The ventral surface of the basihyal is also strongly convex from side to side at its narrow portion and also along a ridge which thence continues antero-posteriorly across its expanded part and on into the *urohyal.* On either side of this median ridge the under surface of the expanded part is gently concave.

The hinder border of the basihyal, on either side of its continuation into the urohyal, presents an elongated articular surface, concave transversely, slightly convex dorso-ventrally, for junction with the *hypobranchial.*

The *urohyal* is one with the basihyal and continues on without change of direction, tapering a little, to its somewhat blunt, slightly enlarged termination, which is tipped with cartilage. Its dorsal margin appears slightly concave antero-posteriorly, when the urohyal is viewed in profile. Its length is three-quarters the length of the basihyal.

The *entoglossum* consists of two lateral parts (entoglossals), which meet together to articulate with the saddle of the basihyal and so form a little transverse isthmus of bone, whence each entoglossal extends for a considerable distance forwards and for about half as great a distance backwards, each pair of prolongations slightly diverging as they proceed. The ends of the anterior prolongations are united by cartilage, between which, the isthmus of bone before mentioned, and the two anterior limbs of the entoglossals a vacant space is included which is longer than broad. The dorsal surface

Fig. 1.



Hyoid of *Psittacus erithacus*, $\frac{1}{1}$.

A. Dorsal aspect; B. Ventral aspect; C. Lateral aspect.

Explanation of the lettering.

b, basihyal.
e, entoglossum.
c, concavity or cup-like excavation.
p, parahyal process (see figs. 1 & 6).
parahyal arch (see figs. 2, 3, 4, & 5).
u, urohyal.
hb, hypobranchial.
cb, ceratobranchial.
h, symphysis of crura of parahyal arch.

of the bony isthmus lies, as it were, at the bottom of a bony valley formed by the much inwardly inclined dorsal surfaces of the rest of the two entoglossals.

Each entoglossal presents a dorsal surface which is slightly concave from within outwards and looks upwards and inwards and is much curved, convex dorsad, antero-posteriorly, especially at and behind the bony isthmus, the part posterior to which has a dorsal surface convex in both directions. The ventral surface of each entoglossal is correspondingly inclined downwards and outwards and is antero-posteriorly concave, while it is slightly convex dorso-ventrally at its anterior portion, the hinder portion being dorso-ventrally concave. Each entoglossal expands slightly towards its anterior end, where it shows a tendency to bifurcate; the dorsal surface of this most anterior part is concave, while ventrally it is flattened. Postaxially, its end is somewhat more pointed, but does not bend much ventrad at its point. When seen in profile the dorsal margin of each entoglossal is at first slightly concave, antero-posteriorly, and then strongly convex. Its ventral margin is nearly straight (with only a rudiment of a ventrad process), till we come to the anterior part of the descending posterior portion of the entoglossal, where it expands dorso-ventrally, bends mesiad, and joins its fellow of the opposite side. It then rapidly narrows to its hinder end, the expanded part being crossed by a slight antero-posterior ridge concave ventrad. Anteriorly each entoglossal hardly diminishes perceptibly in vertical extent and appears truncated at its termination.

The posterior side of the bony isthmus, formed by the junction of the entoglossals, presents an articular surface strongly concave from side to side and convex dorso-ventrally.

The anterior margin of the bony isthmus is strongly concave from side to side.

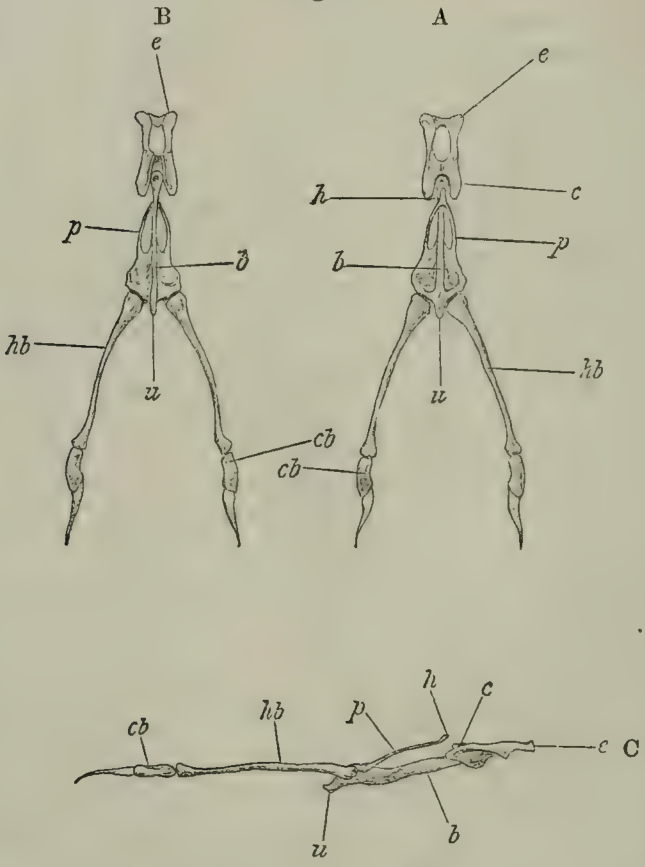
Each *hypobranchial* is twice as long as the basihyal. It is stout and much laterally expanded towards its preaxial, articular end, the articular surface of which corresponds with that of the basihyal to which it is applied. At the postaxial end of its preaxial third it contracts rather rapidly, and is slender thence till close to its hinder end, where it expands and articulates with the ceratobranchial. The anterior part of the dorsum of each hypobranchial is antero-posteriorly grooved.

Each *ceratobranchial* is in the form of a small flattened ossicle, a little more than twice as long as broad, strongly bent concave mesiad, not tapering towards its termination, which is tipped with cartilage.

LORIUS DOMICELLA. (Fig. 2, p. 166.)

Compared with *Psittacus erithacus*, as regards the structure of the hyoid, *Lorius domicella* has the *basihyal* more elongated and its posterior part less expanded laterally and less quadrate in shape. The dorsal lip of its anterior articular surface is more elevated (so that its summit is visible when the hyoid is viewed in profile) and has on its summit a cup-like excavation (c), which is an exaggeration of the slight depression which exists there in *P. erithacus.* The median dorsal ridge is very marked where it traverses the posterior, enlarged, part of the hyoid, and there is a marked concavity on either side of it as each outer margin of the expanded part of the basihyal is somewhat elevated. These raised margins are continued on into a very long and very delicate ossicle on either side, which seems to represent the parahyal process of *P. erithacus.* If so, these very long and extremely delicate parahyal processes pass forwards, curving gently mesiad till they meet in a symphysis which is placed above and but little behind the dorsal cup before mentioned. Thus these processes form a *parahyal arch* (p), which has a singular resemblance to an "os furculum," the symphysis

Fig. 2.



Hyoid of *Lorius domicella,* ½.

A. Dorsal aspect; B. Ventral aspect; C. Lateral aspect.

(Lettering as before, see p. 164.)

calling to mind the "hypocleidium" (*h*). Each crus of the arch has a slight sigmoid flexure as it advances from its base, the first flexure convex dorsad and the more distal one convex ventrad. The symphysis, as seen above, narrows somewhat towards its apex (which is blunt) and is slightly convex transversely on its dorsal side and flattened beneath or even slightly concave transversely. The symphysis is about as broad as the two crura combined, and each crus continues of nearly the same breadth till it closely approaches the symphysis.

The *urohyal* is relatively as well as absolutely much shorter than in *P. erithacus* and more laterally compressed. It also bends decidedly ventrad towards its apex, which is more truncated.

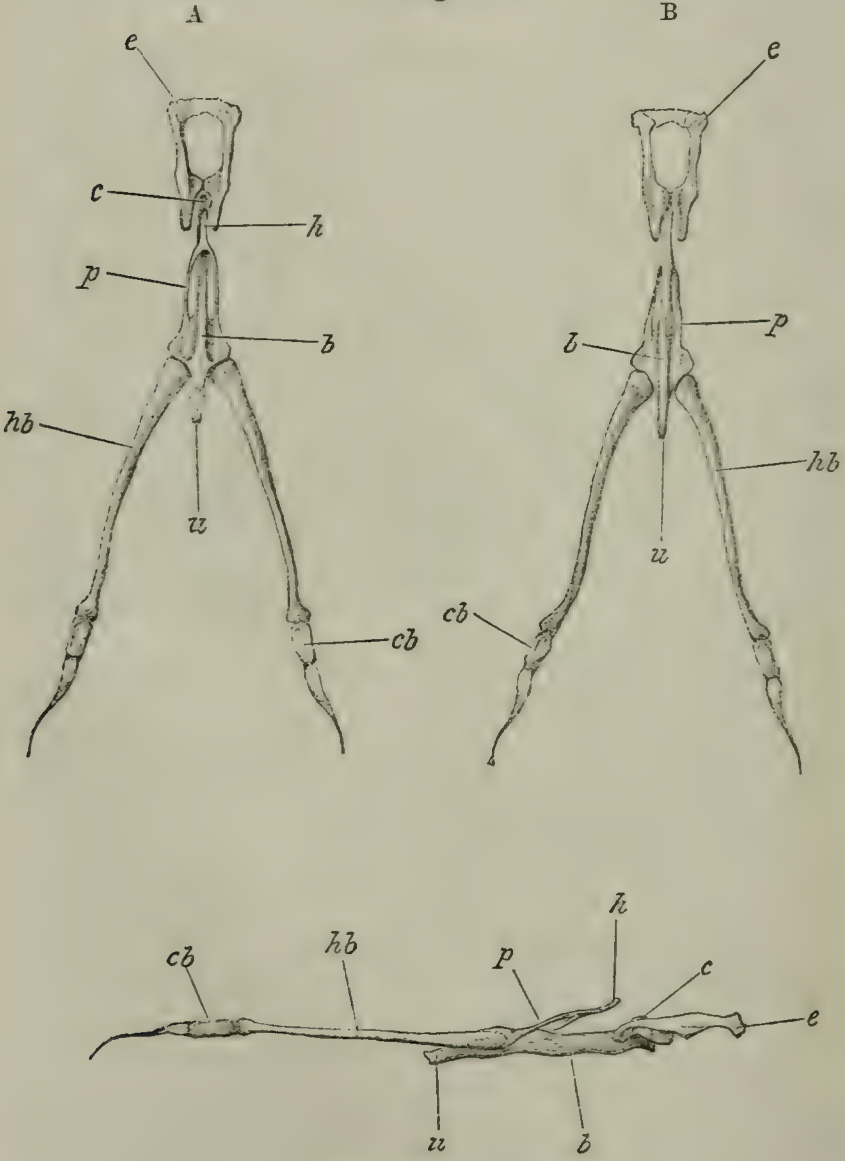
The *entoglossum* has each of its lateral elements more laterally compressed than in *P. erithacus*, so that when seen above it appears much more slender, especially towards its antero-posterior middle. Towards its anterior end it expands transversely to a considerable extent, the expansion looking upwards and inwards dorsally, and downwards and outwards ventrally. Each terminal expansion develops three minute processes from its anterior margin, whereof two very slightly marked ones are directed forwards and one inwards to nearly meet its fellow of the opposite side, a small piece of cartilage completing their junction and that of the anterior ends of the two entoglossals, but for which there would be a conspicuous median notch at the front end of the entoglossum. This whole anterior part constitutes a structure very concave dorsad and convex ventrad. The hinder end of each entoglossal also expands and meets its fellow of the opposite side, the space thus enclosed by the two entoglossals being longer and narrower relatively than in *P. erithacus*.

The posterior extension of each entoglossal is slightly longer relatively and more pointed than in *P. erithacus*. The dorsal surface is slightly convex in both directions, though the two entoglossals incline ventrad to their posterior junction, so that the whole entoglossum is dorsally deeply concave transversely in front of its junction with the basihyal.

When the entoglossum is viewed laterally, its anterior end is seen to be vertically expanded and with a slightly rounded anterior margin. Backwards from this vertically expanded anterior portion, the entoglossal contracts dorso-ventrally rather suddenly and then slightly expands postaxiad with a rather convex dorsal margin and a strongly concave ventral one. This concavity is produced by the projection ventrad of a strongly marked process which may be distinguished as the *anterior lateral process*, of which there is but a rudiment in *P. erithacus*. Behind this another, larger process, which may be named the *posterior lateral process*, projects more ventrad still, there being, of course, a strong concavity, or notch, between these two processes. This posterior lateral process consists, as in *P. erithacus*, of that ventral portion of the entoglossum which goes to join its fellow of the opposite side and form the bony isthmus in front of the articulation of the entoglossum with the saddle-shaped surface of the basihyal. Behind this the posterior process of each entoglossal projects backwards and somewhat downwards towards its apex, its dorsal margin being slightly convex and its ventral margin concave towards it hinder end. Its outer surface is very concave.

The *hypobranchial* is much shorter, relatively, and also more

Fig. 3.



Hyoid of *Lorius flavopalliatus*, $\frac{1}{1}$.

A. Dorsal aspect; B. Ventral aspect; C. Lateral aspect.

(Lettering as before, see p. 164.)

slender than in *P. erithacus.* It is also more curved, concave downwards, and presents a lateral sigmoid flexure, the anterior curve whereof is convex outwards, while the more distal one is convex mesiad. It also expands slightly more transversely at its distal end.

The *ceratobranchial* is much like that of *P. erithacus,* but slightly less expanded laterally and a little more curved, concave mesiad.

LORIUS FLAVOPALLIATUS. (Fig. 3, p. 168.)

The hyoid of *Lorius flavopalliatus* agrees with that of *Lorius domicella* except in the following few particulars.

The *basihyal* is more strongly and sharply bent dorsad towards its preaxial end. The two lateral halves of its posterior margin form a more decided angle with each other, open forwards. Each postero-external margin of the basihyal plate forms a much more marked and smaller angle with the proximal part of the crus of the parahyal arch. The crura of the arch are somewhat shorter, its symphysis being much longer and more pointed. The symphysis curves, antero-posteriorly, more strongly concave downwards.

The *entoglossum* has its constituent halves diverging more preaxiad. Seen laterally the anterior end of each entoglossal develops three short, vertically superimposed marginal processes.

The *urohyal* is not so much bent ventrad towards its distal end.

The *hypobranchial* is relatively slightly shorter.

The *ceratobranchial* is less curved.

EOS RETICULATA. (Fig. 4, p. 170.)

Basihyal—This bone in *Eos reticulata* has its expanded posterior part intermediate in form between those of *Lorius domicella* and *Lorius flavopalliatus.* The angle formed by the two sides of its posterior margin is more like that in the former, while the shape of its external margins (behind the origins of the crura of the parahyal arch) are more like those of *L. flavopalliatus.* The crura are rather shorter than in either of those species, though the symphysis of the arch is elongate, but not so much so as in the last-named species. The dorsal cup-like excavation at the preaxial end of the bone is as marked as in either of the before described forms.

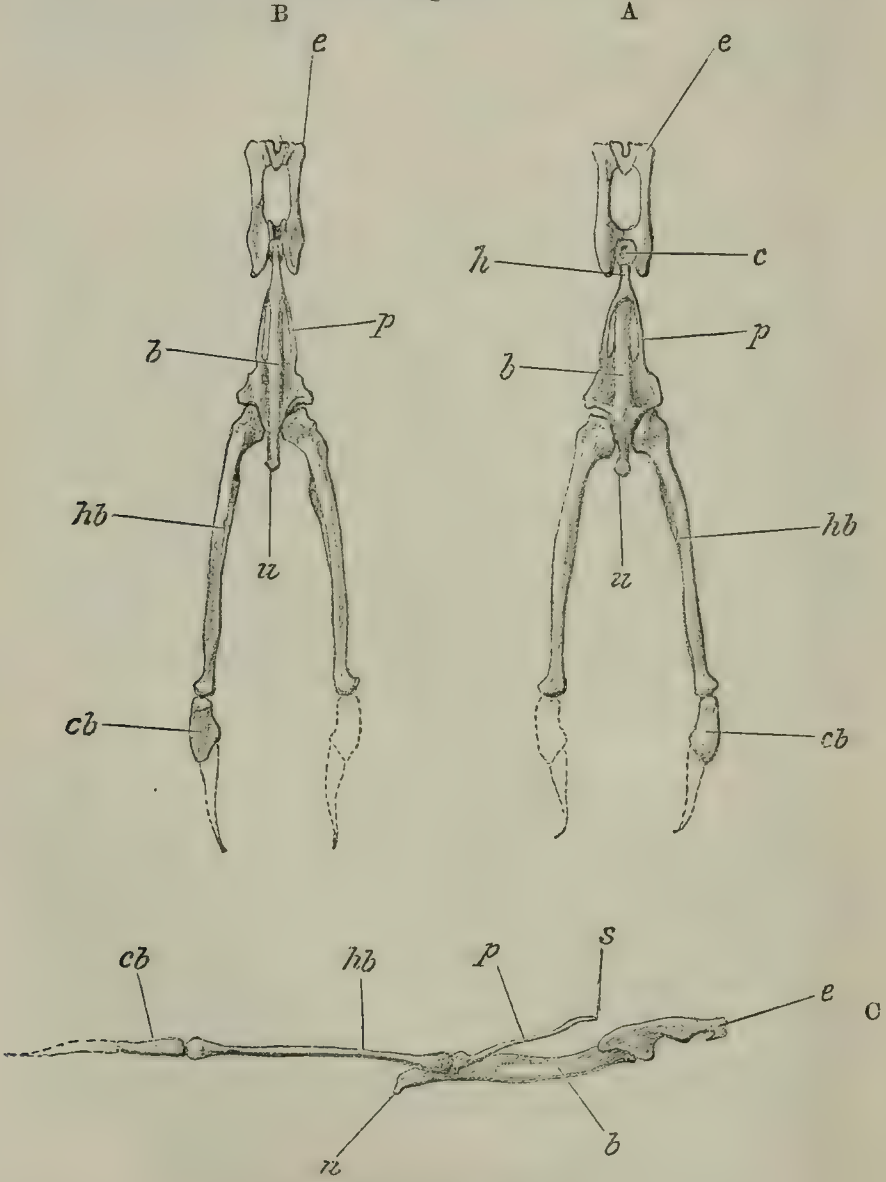
The *urohyal* is very short and bent ventrad at its distal end as in *L. domicella.*

The *entoglossum* has its two lateral parts not so much diverging preaxiad as in *L. flavopalliatus.* The cartilage joining them anteriorly is medianly notched in front and somewhat medianly prolonged behind. Both the lateral processes of each entoglossal are well developed.

The *hypobranchials* are relatively shorter and stouter than in *Lorius*, but with a similar sigmoid flexure.

The *ceratobranchial* broadens more, laterally, antero-posteriorly to its preaxial end.

Fig. 4.



Hyoid of *Eos reticulata*, $\frac{2}{1}$.

A. Dorsal aspect; B. Ventral aspect; C. Lateral aspect.

(Lettering as before, see p. 164.)

Eos indica[1].

In every particular which has been given with respect to the *basihyal*, *urohyal*, *entoglossum*, and *hypo-* and *cerato-branchials* of

---

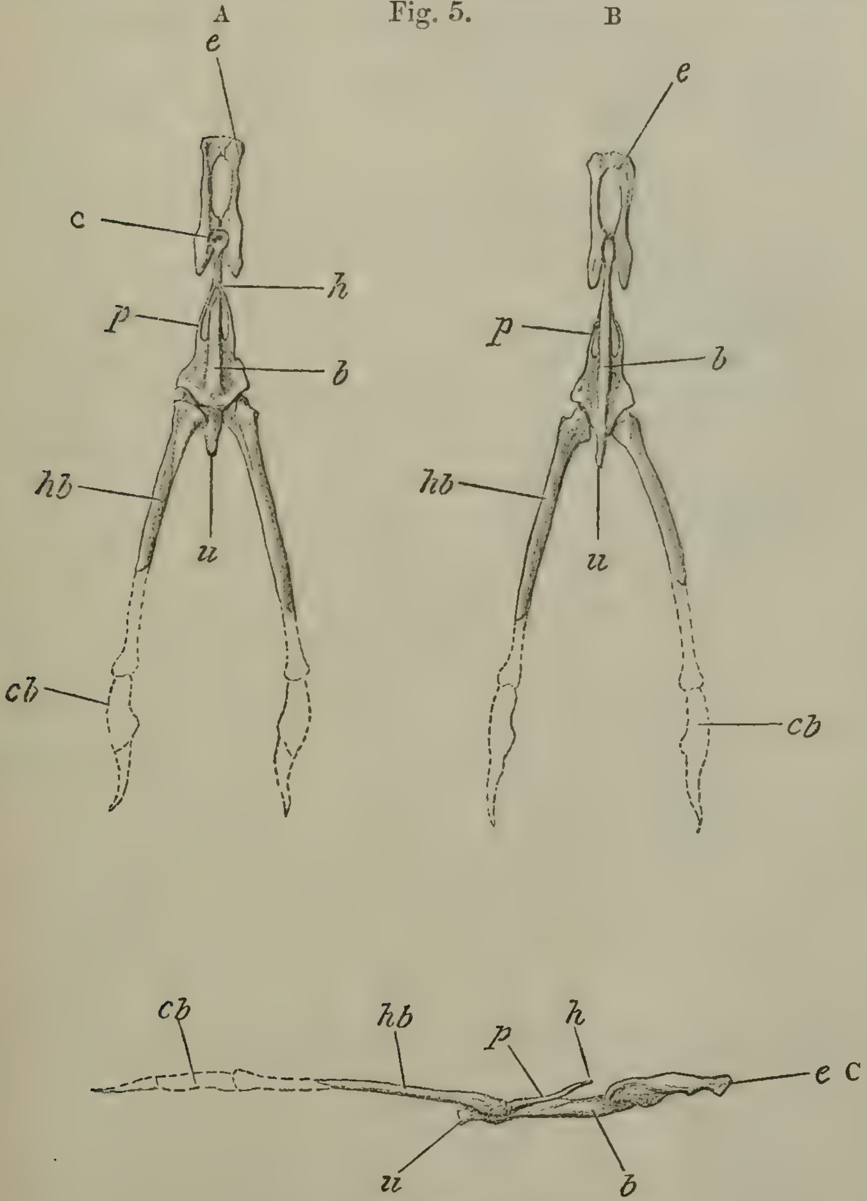
[1] I suspect that the specimen thus named may be really *Eos reticulata*.

Eos reticulata, *E. indica* entirely agrees, save that the cartilage joining the anterior ends of the entoglossals having disappeared, nothing can be said as to its shape.

TRICHOGLOSSUS ORNATUS. (Fig. 5.)

The *basihyal* of this species differs from those of *Lorius* and *Eos*

Fig. 5.



Hyoid of *Trichoglossus ornatus*, $\frac{2}{1}$.
A. Dorsal aspect; B. Ventral aspect; C. Lateral aspect.
(Lettering as before, see p. 164.)

in that the crura of its parahyal arch where they meet are not prolonged into a symphysis. It is possible that a prolonged symphysial portion may have been broken off, but I cannot detect any trace of the fracture.

The *urohyal* is very short, but slightly deflected ventrally towards its truncated distal end.

The *entoglossum* is rather more prolonged compared with the basihyal. It presents all the characters already noted in *Lorius* and *Eos*. The ventral prominences of the preaxiad expansions of the two entoglossals are in contact.

The *hypobranchials* were broken in the specimen examined, but seem much like those of *Lorius domicella*, but perhaps a little stouter.

STRINGOPS HABROPTILUS. (Fig. 6, p. 173.)

The hyoid of *Stringops* differs altogether from those of *Lorius*, *Eos*, and *Trichoglossus*, and has a general resemblance to that of *Psittacus erithacus*.

The *basihyal* has its anterior part much deeper and more laterally compressed than in *P. erithacus*, while its posterior, subquadrate part is hardly so much expanded laterally. The superior margin of the basihyal, when laterally viewed, is more concave dorsally, while its inferior margin is more convex ventrally, the bone being more bent concave upwards. There is hardly a perceptible concavity on the dorsum of the saddle's upper lip. The two halves of the posterior margin of the basihyal are each more concave and form a more marked angle with each other. The parahyal processes are longer, stronger, and while proceeding forwards and very slightly inwards, ascend much more sharply dorsad and slightly expand at their extremities.

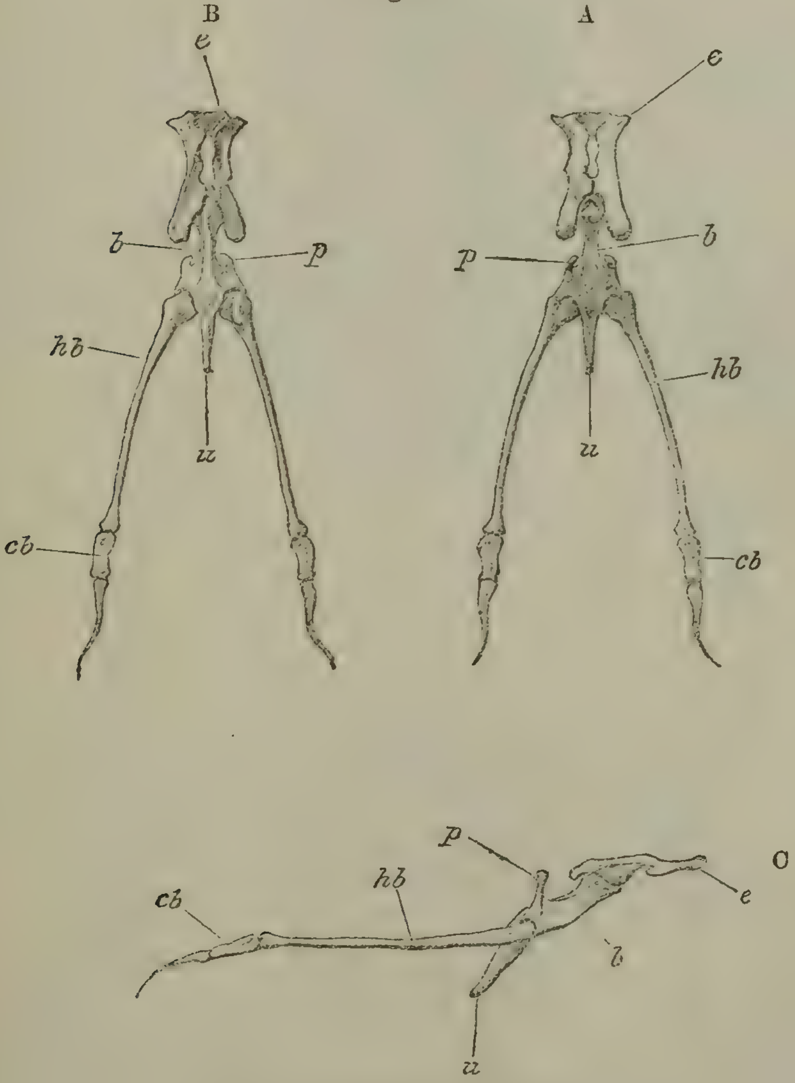
The *urohyal* is much as in *P. erithacus*, only more inclined ventrad towards its distal end.

The *entoglossum* has a narrower median vacuity than in *P. erithacus*, while each anterior and posterior extremity projects more outwards, especially the two anterior extremities, so that the anterior half of each lateral margin is much more concave. The dorsal surface of the entoglossum is also very much more flattened than in *P. erithacus*. Thus the bony isthmus formed by the median junction of the two inwardly projecting portions of the two entoglossals (just in front of the basihyal saddle) is quite on the dorsal surface of the entoglossum, instead of being sunk at the bottom of a strongly marked concavity—as it is in *Psittacus*, *Lorius*, *Eos*, and *Trichoglossus*. The dorsum of each entoglossal process projecting back behind the bony isthmus is also flattened, though faintly grooved antero-posteriorly.

Seen ventrally, each entoglossal presents a wide shallow concavity at its laterally expanded preaxial end. Behind this is the prominence of the anterior lateral process, and behind this again is the marked concavity (looking externad as well as ventrad) of the hindermost part of each entoglossal.

Seen laterally, the entoglossal shows a sigmoid curvature, its dorsal margin being concave above anteriorly and convex posteriorly. Thus seen, the preaxial end does not show any expansion, but there is a distinct anterior lateral process separated by a notch from the posterior one; the outer surface of the posterior part of the entoglossal, which looks ventrad as well as externad, is very strongly concave dorso-ventrally.

Fig. 6.



Hyoid of *Stringops habroptilus*, $\frac{1}{1}$.

A. Dorsal aspect; B. Ventral aspect; C. Lateral aspect.

(Lettering as before, see p. 164.)

The *hypobranchials* are elongated and, save for their anterior curvature, almost straight.

The *ceratobranchials* are slightly broader osseous palettes than in *P. erithacus*, and they are hardly as much curved.

It is interesting to find that this part of the anatomy of *Stringops* would alone suffice to declare the essentially Psittacine nature of the bird. It also proclaims it to be a peculiar Psittacine form. With no affinities whatever for the Loriidæ (so far as I have yet been able to examine that family), it is also very distinct from *Psittacus*. I have not been able to find any representation of a Psittacine hyoid to which that of *Stringops* shows any marked resemblance.

In conclusion I think we have, in the existence of the parahyal arch, a very distinctive character for at least three genera of Loriidæ; and, when we consider how closely allied other genera of that family are to *Lorius*, *Eos*, and *Trichoglossus*, we may, I think, expect to find that a general resemblance exists between the hyoids of the entire group. In other skeletal characters there are some interesting differences between *Psittacus* and *Lorius*, as I hope to be permitted on some future occasion to point out.

2. A Study of the Internal Anatomy of *Thyas petrophilus*, an unrecorded Hydrachnid found in Cornwall. By A. D. Michael, F.L.S., P.R.M.S., &c.

[Received February 27, 1895.]

(Plates VII.–IX.)

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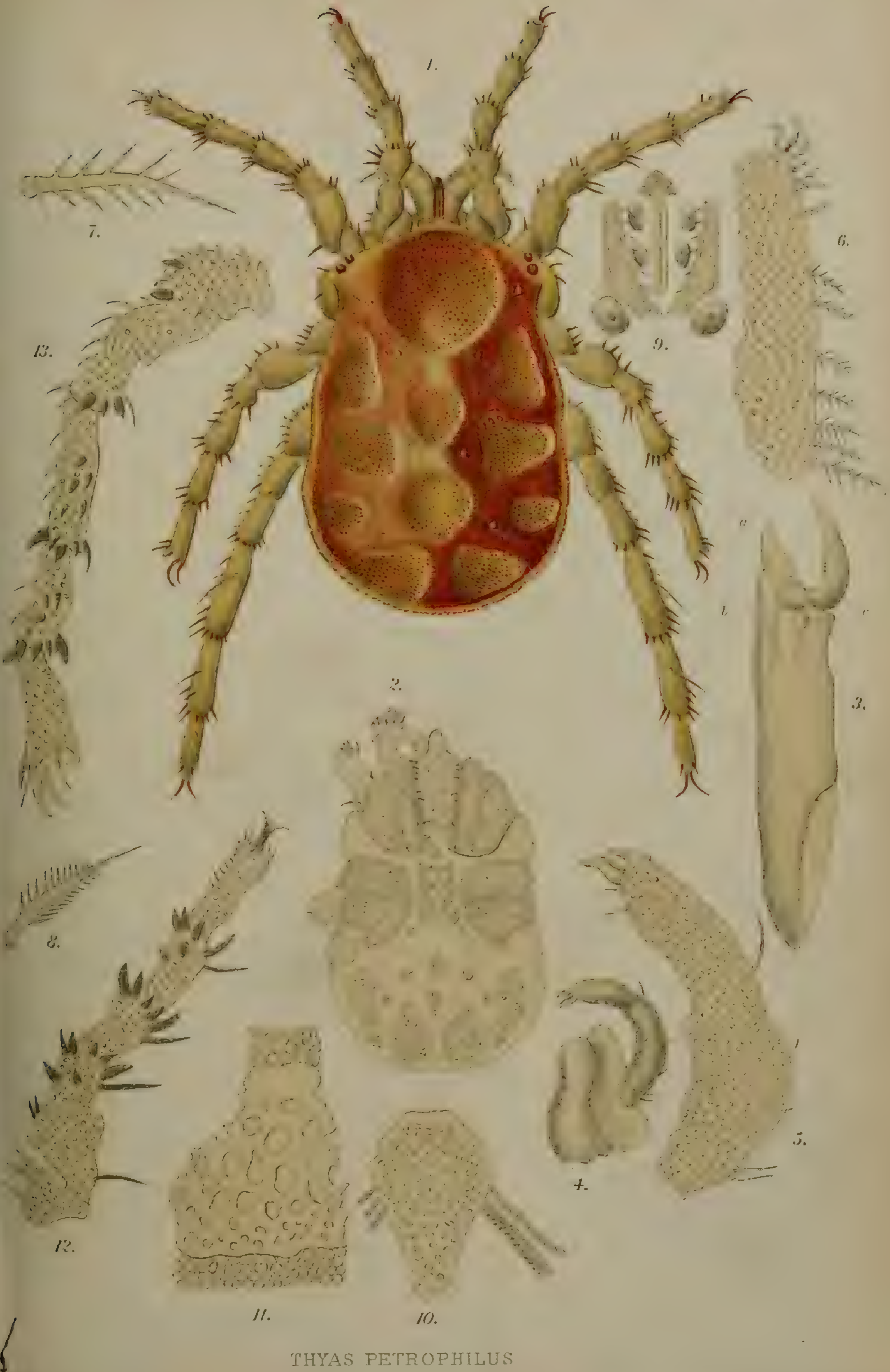
The beautiful Acarid which forms the subject of this paper was discovered by my friend Mr. E. Bostock when we were collecting together in the neighbourhood of the Land's End, Cornwall; I have since met with numerous specimens in the same locality, but have not hitherto found it elsewhere. So far as I have been able to ascertain it has not been previously observed, and is unrecorded.



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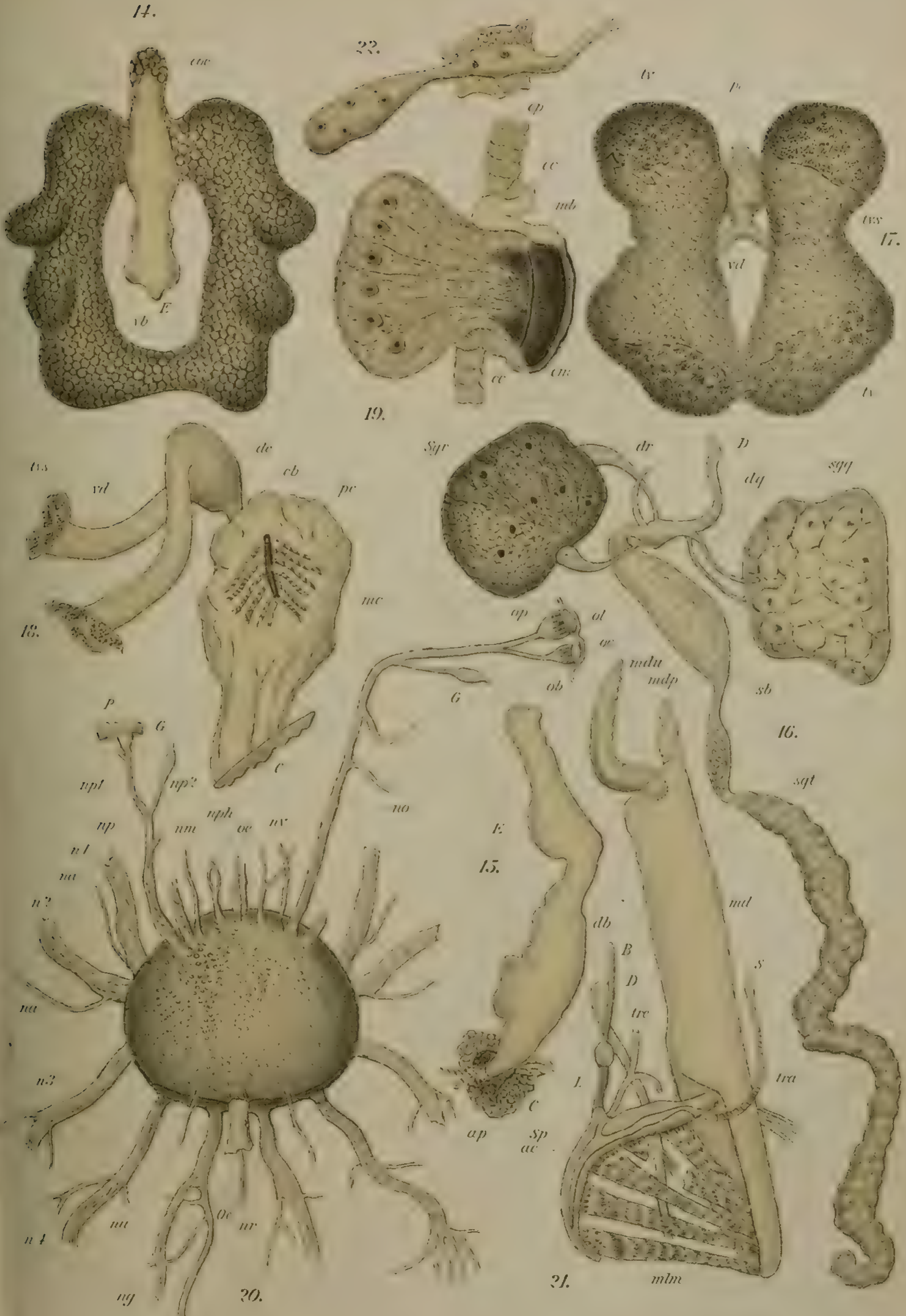

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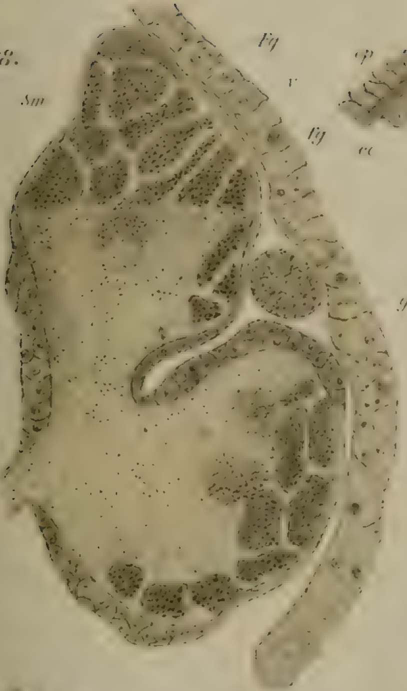

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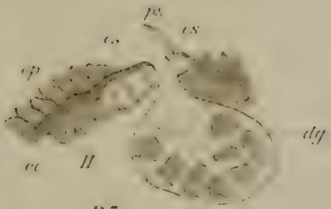

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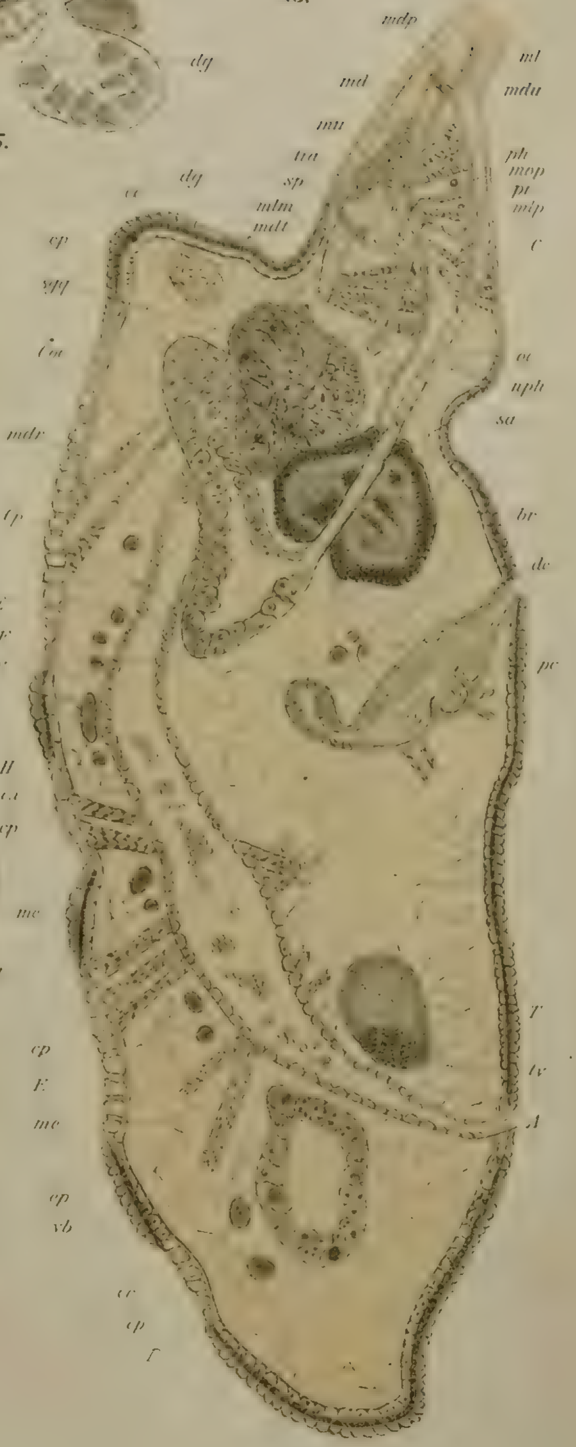

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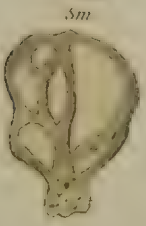

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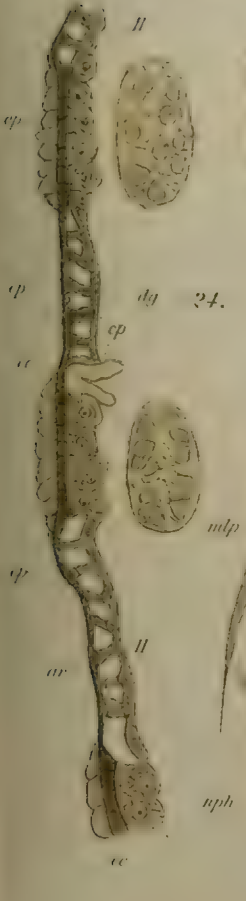

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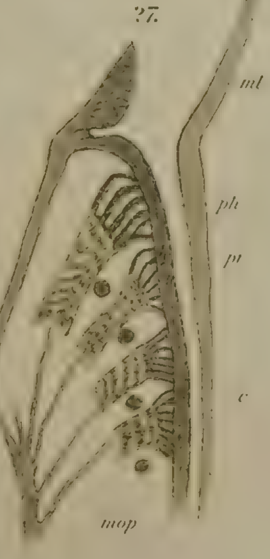

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The habitat of the creature is somewhat curious; it was found in a very small stream of fresh water, just where it comes tumbling over the granite cliffs and runs down the sands into the sea. The part where the Mites were found was the bottom, not the top, of the cliff; the stream there is distinctly fresh water, but is only three or four feet above high-water mark at the high spring-tides; so that when the wind is on shore and the sea at all rough considerable quantities of salt-water must be carried into the stream, and even at ordinary times a good deal of salt spray must reach it. I searched in vain for the Acarid higher up the same stream, and I have not hitherto succeeded in finding it in any of the other streams in the same district. Although a Water-Mite, it is not found swimming; like other members of the genus it is adapted for crawling only; but I have not ever seen it crawling on the bottom or on the water-plants, although of course it must do so. I have invariably found it either in small chinks and splits in the rock, where it can only be discovered by carefully chiselling away the rock in likely places, or clinging to the underside of large stones lying in deep pools; I thought from the latter position that the Acarids had been carried down the stream, but, as before stated, I was not able to find them higher up.

The Mite is very conspicuous when its hiding-place is discovered; it is of a beautiful scarlet colour shaded and varied with orange, and the soft cuticle is diversified by a number of porous plates of clear yellow chitin sunk a little below the general level of the skin, so as to form shallow depressions. The legs are one of the most striking features, as most joints are furnished with a radiating whorl of large yellow spines tipped with scarlet, which give a very brilliant appearance; the colours are difficult to preserve after death.

The Acarus appears to belong to the genus *Thyas*, the principal characters of which are as follows:—Hydrachnidæ with the eyes placed at the side of the body (far apart), with two-jointed mandibles, without swimming-hairs on any of the legs, and with the dorsal cuticle furnished with numerous separate chitinous plates. It is by the last-named character that the genus is finally distinguished from Kramer's genus *Aturus*.

I propose calling the new species *Thyas petrophilus*, from its habits of life.

THYAS PETROPHILUS, n. sp. (Plate VII. figs. 1, 2.)

	♂. mm.	♀. mm.
Average length including rostrum about	1·00	1·35
,, ,, of rostrum only about	·10	·15
Greatest breadth about	·65	·70
,, thickness, dorso-ventrally, about	·40	·50
Length of legs, 1st pair about	·38	·50
,, ,, 2nd ,, ,,	·50	·65
,, ,, 3rd ,, ,,	·65	·85
,, ,, 4th ,, ,,	·85	1·10

Colour orange-scarlet, varying in different parts of the body in shades from orange to scarlet. Chitinous plates on the dorsal and ventral surfaces and the legs lemon-yellow; spines on the legs yellow tipped with scarlet.

Form oblong, corners rounded; compressed dorso-ventrally; dorsal surface flat, concave in young specimens.

Texture.—The whole cuticle of the body, where it is not chitinized, is covered by conspicuous rounded papillæ, having an average diameter of about ·005 to ·008 mm. The dorsal and ventral surfaces are, however, mostly occupied by numerous porous chitinized plates sunk in the cuticle; the epimera, sternal plate, legs, palpi, and maxillary lip are all chitinized and pierced by pores averaging about 150 to the millimetre on the epimera and sternum, and about 250 to the millimetre on the legs and palpi; while the actual pores themselves have an average diameter of about ·003 in the former, and ·001 in the latter situations.

Eyes crimson, placed at the antero-lateral angles of the body; the two eyes in each pair quite distinct. I cannot find any trace of a fifth median eye.

Maxillary lip (fig. 4).—This, as usual, forms a deep trough, slightly narrowed toward the anterior end, which is sharply truncated and slightly bifid.

Palpi (fig. 5) have the second joint the thickest, the fourth much the longest, the fifth a blunt claw. They are what is known as the *Hydrophantes*-palpus, *i. e.* the dorsal part of the fourth joint projects considerably parallel to the fifth, so that the fourth and fifth form a sort of chela.

Mandibles (figs. 3, 21) almost straight; the chitinous wall of the dorsal half of the first joint much longer than that of the ventral. There is a membranous anterior projection (*mdp.*) overhanging the second joint, which joint is hook-like, movable, and serrated on its upper (concave) edge.

Dorsal surface (fig. 1).—This is mostly covered by chitinous plates sunk in the cuticle, and which are usually at the bottom of small depressions; these depressions are formed partly by the drying up and often entire rubbing off of the portion of the external layer of the cuticle which overlies the plate, and partly by these plates giving points of attachment for the powerful dorso-ventral and other muscles, by which they are drawn downward (into the body) a little. These plates are of two kinds: one consists of large, or comparatively large, plates thickly and irregularly pierced by areolations of various sizes and shapes, but so large and numerous that the holes cover a larger area than the chitin; a small portion of one of these plates is shown at fig. 11. The second kind consists of quite small plates, mostly having some approach to the round or square form, and mostly with an almost circular opening in the middle and the rest of the plate pierced by fine pores more regularly placed than those on the larger plates. Each smaller plate bears a small hollow colourless hair or spine close to the central hole, if there be one, but the hair is always present; such hairs do not occur on the larger plates. The larger plates are arranged in three irregular longitudinal rows; the same plate rarely exactly agrees in form or size in two individuals or on opposite sides of the body, and seldom, in form, even on the two sides of the same plate; but the arrangement may be said to be approximately as follows:—The central line consists of three unpaired plates, of which the anterior is much the largest, and much larger than any other plate on the body; it is heart-shaped. The central and posterior are nearer to a square or oblong form. The lateral rows are each composed of four plates of irregular forms; the hindmost is nearly triangular and approaches near to its fellow on the other side of the body. I am not sure that in some specimens some of these plates may not coalesce or be broken up into more than one.

The smaller plates generally form an irregular longitudinal line of four on each side, starting from between the first large central plate and the eyes and passing between the central and lateral lines of large plates.

The edge of the body.—There are some of the small plates, and one or two of the nature of the large plates, on the actual lateral and posterior edge of the body.

The ventral surface (fig. 2).—The epimera are arranged in two groups on each side of the body, those of the first and second leg being anchylosed together; and the same taking place with those of the third and fourth, but a strip of soft cuticle intervening between those of the second and third. Between the epimera of the first pair of legs, but not attached to them, is a plate formed of the fused sternal plate and maxillary lip; this plate does not extend as far back as the epimera do.

The body forms a lateral, almost square, projection between the epimera of the second and third legs.

There are, on the ventral surface, two pairs of irregular-shaped plates near the posterior margin, of the nature of the larger dorsal plates; four or five pairs of the nature of the small dorsal plates; the anal plate (if that be its proper name); a small plate just anterior to the anal and like it in form, but turned in the reverse direction; and, finally, the plates surrounding the genital opening. The anal plate (fig. 10) has a round central opening, which is the exterior orifice of the excretory organ and is closed by two soft labia. This opening is surrounded by a ring of chitin rather denser than the remainder of the plate, which ring is pierced by a regular row of very fine pores. A little further out is a concentric ring of rather larger pores, and the rest of the plate has pores similar to those in the epimera &c.

The sclerites surrounding the genital aperture are similar in both sexes, and consist of a small, anterior, median, almost triangular plate of rough chitin with the point directed forward, and two paired lateral plates, the shape of which will be best gathered from the drawing; these nearly touch posteriorly, but are further apart anteriorly. Two pairs of the so-called genital suckers are situated between these lateral plates, and one pair of larger ones behind and outside their postero-lateral edges. The genital opening itself is a longitudinal slit closed by soft labia in both sexes.

The epimera of the first pair of legs are fringed on the edges nearest the median line of the body by a series of beautifully feathered or pectinated hairs (fig. 6), which vary considerably; three or four at the anterior are curled over at their ends and plumose, the remainder are some finely (fig. 8) others more coarsely (fig. 7) pectinated; most of them are terminated by a long fine spine, which is not pectinated. There are a few very small, curved, colourless hairs on the epimera and the hind margin of the body.

Legs (figs. 12, 13).—The legs gradually increase in length from before backward; they are entirely chitinized and entirely without swimming-hairs; they are terminated by strong didactyle claws; the tarsi, particularly the two hind pairs, are enlarged at their distal ends and excavated so as to form deep cups. All the legs are armed with a number of large orange-scarlet spines, or spines tipped with that colour, which form the most striking feature of the species; they are mostly lanceolate or laurel-leaf shaped, but some are straight; the largest are arranged in radiating whorls round the distal ends of the third and fourth joints of the first pair of legs and the third, fourth, and fifth of the other pairs: there are also two large spines, one on the underside of the second joint of each second leg, and several similar but smaller spines on the upperside of the same joints in the first three pairs of legs and the underside of the fourth; there is also a pair at the distal end of the tarsus of the third and fourth legs, curving over and protecting the claws. There are lines of somewhat similar, but uncoloured, spines on the outer edges of the fourth coxæ. There are numerous other hairs on the legs, particularly on the outer side of the fourth legs; these hairs are mostly strongly curved, colourless, soft, and diminishing to a point; there are smaller fine hairs on the tarsi.

The Integument (Plate VII. fig. 11; Plate IX. figs. 23, 24, 25).

This varies in thickness in different parts of the body; it may be said to consist of three layers, or it might be considered two layers, the outer being double. Treating it as three layers, the outer, which may be called the "epiostracum" (fig. 24, *ep.*), consists of a single row of epithelial cells, rounded or conical on the outer side, flat on the inner side; these cells form the papillæ with which the soft parts of the body, particularly the dorsal surface, are coated externally. They are loosely arranged and vary in form a good deal in different parts of the creature; those towards the anterior end being, as a rule, the most papillose. The second layer, which may be called the "ectostracum" (figs. 24, 25, *ec.*), consists also of a single row of cells; but they are more cubical and form a dense and thoroughly united tissue with a flat surface on both sides: otherwise the cells are no doubt of the same nature as those of the outer layers, the latter being more or less transformed or perishing. The inner layer (figs. 24, 25, *H.*), which may be called the "endostracum," is the living layer or hypoderm. It is in the cells of this layer that the chitin is deposited which forms the chitinous plates of the cuticle. The cells in which the chitin is deposited occasionally increase greatly in size, the swelling being inward; so that at the enlarged point the chitin projects further into the body than the other portions of the cuticle (fig. 24, *cp.*, the hind end of the first plate), and the larger plates are so abundantly pierced by large irregular holes or areolations that in section the chitin often looks like detached rods, or laminæ. The chitin is often thinner at the edge of the plate than elsewhere, and in that case gradually diminishes to an edge at the periphery, so as to present a knife-edge section. The chitin here is pierced only by smaller pores, not by the large areolations. The cells of the hypoderm generally send protoplasmic tongues into the areolations, often entirely filling them. Above the chitinous plates the epiostracum often persists, as observed by Schaub in *Hydrodroma*: when it does so it most usually dries up and becomes a very thin layer of dead flattened cells; but the compression or crumpling of the convex outer side produces a greater thickness or opacity in the middle of the cell, which gives the plates a somewhat spotted appearance over the areolations. Most commonly, however, particularly on the dorsal surface, the epiostracum not only dries up but rubs off and is entirely lost; the ectostracum also, in the same cases, dries up above the plate and becomes an extremely thin layer; so that the two outer layers of the cuticle over the plate are not nearly so thick as in other situations; hence the plates of the dorsal surface lie at the bottom of shallow depressions; this applies to the larger areolated plates only, not to the small hair-bearing plates.

The larger plates give attachment on their inner sides to the dorso-ventral and other muscles.

The Dermal Glands (Plate IX. figs. 23, 24, 25, 26).

The general arrangement, comparative size, and position on the dorsal surface of these glands, which are so well-known in the Hydrachnidæ, is very similar to that described by Schaub in *Hydrodroma* and by Haller[1]; the glands are not, however, so strictly confined to the dorsal surface as they seem to be in *Hydrodroma*; there are some on the edge of the ventral surface near the anterior and posterior ends of the body. The glands themselves differ considerably from those described by Schaub, inasmuch as they are entirely without the chitinous external coating and the chitinous network of strengthening ribs which that author found; they are enveloped simply by a soft membranous tunic, and are formed of large, delicate, very loose cells, in which a nucleus is rarely to be detected: these cells stain but slightly, and the greater number are usually found to have broken down, either during the life of the specimen or during its preparation. There is also occasionally an irregular central protoplasmic mass, and the whole is joined by delicate threads. It seems not improbable that the absence of chitinization from the exterior tunic of these glands may be correlated with the much greater chitinization of the external cuticle in *Thyas* than in *Hydrodroma*. Schaub and Haller appear to have found that the mouth of each of these glands was surrounded by a thick ring of chitin, and was in connection with a more or less triangular chitinous sclerite bearing a small spine, which may be regarded as protecting the opening; neither of these conditions, however, is to be found exactly in *Thyas petrophilus*. The dermal glands of this species discharge to the exterior either through a largish central hole in one of the numerous smaller chitinous plates in the cuticle (fig. 25, *cs.*), each of which plates bears a small hollow spine (*ps.*), or else at the edge of a plate, usually in the former manner; the sclerite is, however, distinctly a plate with numerous pores, which bears both the hair and the mouth of the gland; there is not one solid ring-like ridge surrounding the mouth and another triangular ridge supporting the hair. I have not been able to make certain of any really definite connection between the dermal glands and these smaller dermal plates, as it seems to me that the number of plates does not agree with the number of glands, and that some of the plates have not the central opening; it is, however, extremely difficult to be absolutely sure on this point.

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[1] "Die Arten und Gattungen der Schweizer Hydrachnidenfauna," Mittheil. der Schweizer entom. Gesellsch. 1882, p. 18.

In a few instances I have found near where the duct emerges a minute and extremely delicate membranous sac within the gland, which sac contains an almost globular structure formed of open irregular network, which stains deeply (fig. 26).

The Alimentary Canal and Excretory Organ (Plate VIII. figs. 14, 15; Plate IX. figs. 23, 27).

I join these two systems, because, in effect, it is impossible properly to separate them in the Hydrachnidæ, and indeed in some other families of the Acarina, *e. g.* the Gamasidæ.

The alimentary canal in *Thyas petrophilus* differs considerably from everything which, to my knowledge, has been described in the family, or indeed in the Acarina at all; although undoubtedly it is a modification of the same general plan.

At the entrance from the mouth to the pharynx I find organs which I suppose are those described by Schaub as "palpenartige Gebilde"; I am not, however, able to regard them as of the nature of palpi; they seem to me, in my species at all events, to be small masses destined either to fit together very closely, and indeed to interlock, and thus form a valve closing the entrance to the pharynx, or else to be separated at the will of the creature, thus completing the pharynx in its office as a sucking apparatus.

The pharynx itself with its muscles (figs. 24, 27, *ph.*) has the same lanceolate form shown by Schaub in *Hydrodroma*, and has an average length of about ·15 mm., by a breadth, in its widest part, of about ·03 mm.; when, however, we come to the construction of the pharynx, and indeed to the question of what really is the pharynx, I do not find that my species at all agrees with Schaub's description and drawings. Of course, as I have not seen Schaub's species, I cannot in any way deny that he is correct as to that species; but if he be, then it seems to me that his species must be quite exceptional, differing entirely not only from what I believe I see in *Thyas* &c., but also from what Croneberg has described in *Eylais*, and Henkin in *Trombidium*. The appearance is so similar in all these cases that the investigator is tempted to doubt whether the difference may not be one of interpretation rather than of actual construction; it is, however, not merely a difference of small detail but of principle. It we refer to Schaub's Taf. i. fig. 1, we shall find that he draws the pharynx (*ph.*) as a fusiform sac continuous in a straight line with the œsophagus, and lying above and upon what he calls a chitinous floor ("Chitin Boden") (his *ch.* 2), into the top of which floor the long, almost perpendicular, muscles coming from above are inserted; this floor he makes joined at its end to a lower chitinous floor (*ch.* 1), which forms the true floor of the mouth; so that the two together form a **V** with the point directed backward and not allowing any food to pass between the two limbs of the **V**, or at all events not to pass beyond the point of union of these two limbs. If we now turn to Schaub's Taf. iii. fig. 6, which is a horizontal section through what he considers to be the pharynx, we find that he considers that organ to be divided into numerous compartments by what he calls disks ("scheibenformige Querflächen"), each compartment containing a ring-muscle which constricts an extremely fine tube passing longitudinally up the middle of the pharynx; this tube he says is the true throat ("Schlundrohr"), through which the food passes. There is not anything to show how this throat expands again when the ring-muscles are relaxed; it would seem to be probably too delicate to do so from its proper elasticity. If we now refer to Henkin's figs. 5 and 7, we shall find that (in *Trombidium*) he draws most of the similar parts, but puts a totally different interpretation upon them. Schaub's upper chitinous floor (his *ch.* 2), to which the muscles are attached, is Henkin's "upper wall of the throat"; Schaub's lower chitinous floor (*ch.* 1) is Henkin's "under wall of the throat"; Schaub's disks are represented (in Henkin's fig. 7) by the tendons which attach the long perpendicular muscles (Henkin's "sucking muscles") to the upper wall of the throat; the upper and under walls, when at rest, still form the **V** shown by Schaub, but they are not joined at the point, and when the sucking-muscles contract the upper wall of the throat is raised, a sucking action is the result, and the food rushes in between the two walls. The fine tube which Schaub calls the throat has not any existence in Henkin's descriptions or figures, nor are any ring-muscles to be found, but the latter are represented by transverse muscles (called by Henkin "swallowing muscles") in the following manner:—The upper and under walls of the throat are not flat surfaces; they are half-tubes like the rain-water gutters placed round the roofs of houses; they both have the convex surface downward and the upper rests upon and within the under; the edges, not the ends, are joined in a slightly flexible manner, and the whole upper wall is more or less flexible, elastic, and movable, while the lower wall is stiffer and more fixed. Thus, when the sucking-muscles (*mlp.*) contract and the upper wall is raised, a crescent-shaped lumen is formed in the pharynx (or throat). The pharynx is contracted again partly probably by its own elasticity, but chiefly by the transverse muscles (Henkin's swallowing muscles) which run straight across from one edge of the half-tubes to the other (his fig. 5, my figs. 23, 27, *mop.*), one band of transverse muscle alternating with each band of perpendicular muscle. Henkin was not the first to describe this arrangement; Croneberg drew and described it most exactly four years previously in *Eylais*; but I have above referred to Henkin rather than to Croneberg because the former gives a sagittal as well as a transverse section, which makes reference easier, and Croneberg shows the pharynx and the œsophagus in the same transverse section, which I do not quite understand; moreover, Croneberg's paper is in Russian. A similar construction was given by MacLeod in 1884 for *Trombidium*, *Hydrachna*, and *Erythræus*[1].

Coming now to the present species, *Thyas petrophilus*, I find the pharyngeal arrangement to agree entirely with Croneberg's and Henkin's descriptions, and not at all with Schaub's; I have examined it with great care by sections in every direction and by dissections, and I cannot find a trace of Schaub's thin tube, his "true throat," while the food certainly seems to pass between the two chitinous floors as Henkin says (figs. 23, 27, *ph.*). The long perpendicular muscles, which I will call the dilatores pharyngis muscles (figs. 23, 27, *mlp.*), raise the roof of the pharnyx (Schaub's *ch.* 2), principally in the median line along which they are attached, and the food rushes in between it and the chitinous floor; the roof by the action of the muscles having been separated from the floor and at its posterior end become continuous with the upper wall (or roof) of the œsophagus, which seems above it when the dilator muscles are not in action. The valve before described now closes the anterior end of the pharynx; the contraction of the transverse muscles (depressores tecti pharyngis or contractores pharyngis) brings the roof and floor close together and drives the food into the œsophagus, its return from which is prevented by a valve. Such, at least, is my reading of the action of the parts; at all events I do not think that there can be any doubt that the passage for the food from the mouth to the œsophagus in *Thyas petrophilus* is below, not above, the chitinous plate, to which what I call the "dilatores pharyngis" are attached. I may say that I have carefully examined similar parts in two or three species of *Trombidium* and other allied creatures, and in every instance have found the construction the same. I have also examined them in some Oribatidæ, e. g. *Cepheus latus,* which, as it eats partly solid food, has a wider œsophagus and pharynx, and shows more plainly, and there the principle is practically the same; although, to admit of the larger extention, there are some muscles for depressing the floor of the pharynx, and there are undoubtedly ring-muscles on the œsophagus. In the Gamasidæ, although the principle is somewhat similar, I have found considerable differences of detail, and even of more than detail[1].

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[1] "La structure de l'intestin antérieur des Arachnides," Bull. Acad. R. de Belgique, 1884, nos. 9, 10.

The mode in which the dilatores pharyngis muscles are attached to the roof of the pharynx in *Thyas petrophilus* is particularly beautiful; I have not seen anything like it drawn or described in other Acarina to my recollection; therefore I have figured it (fig. 27). The muscles of the Acarina are attached to their point of insertion either directly or, more commonly, by means of tendons, which are often very long. Where several separate muscles, or a fasciculus of muscles, are inserted together, their separate tendons usually join some little distance from the point of insertion and form a common tendon; in the present instance, however, the dilatores pharyngis are mostly strap-like muscles passing diagonally from where they arise to their insertion; each muscle appears quite separate, each may possibly be a band of muscles attached by their edges; but it has not any appearance of being so, nor does it differ from the appearance of other strap-like muscles which are each attached by a single tendon. In the present instance, however, each muscle widens out a little towards its inserted end, and that end is attached to the point, or rather line of insertion, by four or more separate tendons varying from about ·005 mm. to about ·015 mm. in length and which diverge a little, thus giving the muscle a grasp over a large surface of the pharyngeal wall which it has to raise; a similar arrangement is found in some of the other broad muscles of the present species, but not so well developed. These dilatores pharyngis muscles are innervated by a special azygous nerve (figs. 20, 23, 27, *nph.*) arising from the supra-œsophageal portion of the brain (or central ganglion) almost immediately above the œsophagus, and running parallel to and above the œsophagus, until the pharyngeal muscles are reached, when it divides, sending off a twig to each dilator muscle. The whole course of this nerve may be beautifully seen in one or two of my preparations. I call it the pharyngeal nerve. I do not find that Schaub says where his phanyngeal muscles are innervated from, but Henkin (in *Trombidium*) draws and mentions this nerve, but does not appear to have traced it to its origin. Croneberg in his fig. 16, *Eylais*, draws two paired nerves, which he letters "*n*, *n*"; they come, so far as I can judge, from the supra-œsophageal portion of the brain; each divides into two equal branches very near its origin. In the explanation of his fig. 16, Croneberg says that "*b*, *b*" are the nerves going to the pharynx and mandibles; but there is not any

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[1] "On the Variations in the Internal Anatomy of the Gamasinæ, &c." Trans. Linn. Soc., Zool. vol. v. pt. 9, p. 310, pl. 73.

"*b*, *b*" on the plate, and I think it is a misprint for "*n*, *n*"; I am not able to read Russian, but I fancy they are referred to in the text as "*n*, *n*." They appear to be the same nerves as Schaub letters "*ant.*" and says go to the mandibles and palpi. In his subsequent work on *Trombidium* in 1879, Croneberg draws the azygous nerve starting from the brain and passing above the œsophagus, although he does not say where it goes to.

The œsophagus (fig. 20, 23, *œ.*) is a tube about ·25 mm. long and of about even dimensions throughout; it runs right through the brain in the usual manner, and enters the lower part of the ventriculus in the median line about ·02 mm. behind the brain.

The ventriculus (figs. 14, 23, *v.*) presents very considerable differences from any hitherto described; those figured by Schaub, Henkin, Croneberg, &c., both for Hydrachnidæ and Trombidiidæ, consist of a broad viscus, flattened dorso-ventrally, occupying the greater part of the dorsal surface of the creature, and furnished either with numerous shortish, cæcal, mostly paired diverticula which arise from the dorsal surface and edges of the ventriculus, as shown by Croneberg for *Eylais*, or with a smaller number of diverticula of somewhat larger dimensions, as found by Schaub and Henkin in *Hydrodroma* and *Trombidium.* Of these cæca the posterior median pair turn forward in Schaub's species and backward in the others; Henkin figures and describes them as having their hinder parts pressed together in the median line. In *Thyas petrophilus* I find near the brain a short anterior tract of the ventriculus, which is rather deeper than it is long; *i. e.* it has a horizontal antero-posterior measurement of about ·1 mm. and a perpendicular dorso-ventral measurement of about ·11 mm. in its deepest place, *i. e.* where the œsophagus enters. There is an unpaired median cæcum (*cœ.*) about ·15 mm. in length, which projects forward and slightly upward; it has a somewhat clavate distal extremity and lies immediately over and upon the quadrate salivary glands, where they press against each other in the median line. From the sides of this, which I consider the ventriculus proper, two expansions, as wide as the ventriculus proper, run laterally and form a shallow rounded lobe on each side; they then run straight backward and continue up to about ·1 mm. from the posterior end of the creature, maintaining their full width throughout; they have two shallow irregular lobes on their outer edge and a tendency to a lobate projection of the posterior corner; they then turn inward and *join* without showing any sign of demarcation. The result of this is that the whole ventriculus forms what would be called a ring if it were round instead of square. As it exists it is a hollow square with shallow lobes at the angles, rather more strongly-marked lobes on the outer sides, and a single azygous cæcal diverticulum in the anterior median line. The lobes vary somewhat in different specimens, but the general plan is the same. The whole hollow-square must be considered to be the ventriculus; *the lumen is continuous throughout.*

The dorso-ventral muscles and the excretory organs pass through the hollow of this square. It is not very difficult to imagine how this state of things, exceptional as it is, arose; if we turn to a different family of Acarina, the Gamasidæ, we shall find usually a very small ventriculus, with a pair of small anterior and one or two pairs of long posterior cæcal diverticula: in the Oribatidæ we have a larger ventriculus and a single pair of posterior diverticula, often very long. If we suppose a creature with the small ventriculus of the Gamasidæ and the single pair of long cæca found in the Oribatidæ, and suppose these cæca pressed together at their posterior ends, as in Henkin's description of *Trombidium*, we have only to suppose that these two cæca coalesce at their point of contact, and that, the walls becoming obliterated, a continuous lumen is formed, and we have the ventriculus of *Thyas petrophilus*. It is true that we must imagine the coalescence to be so perfect that not a trace of the origin from two paired cæca is left.

The hind gut and excretory organs must be treated as one question; authors are not by any means agreed upon the construction or homologies of these parts in the Hydrachnidæ and Trombidiidæ. Croneberg describes the ventriculus as a viscus closed posteriorly, and not having any connection with anything in the nature of an anus: he says, in fact, that in all the species of both families which he investigated there is an entrance for food into the ventriculus, but not any organ for the discharge of fæcal matter; it must be confessed that at first sight this appears improbable. Croneberg draws an opening on the ventral surface of *Eylais* between the fourth pair of legs which has the appearance of an anus, and which in his figures he letters "*an.*," although I am told that anus would not be quite a correct translation of the Russian expression in his explanation of his plates. In his German paper on *Trombidium*, however, he calls the opening anus "After"; but in both papers he says that it has not any connection with the alimentary canal but only with the excretory organs, and he draws and describes a single clavate sac overlying the ventriculus in the median line, but ending blindly in front, and not having any entrance into the ventriculus, but passing along the median line of its dorsal surface and bending down behind it to the opening "*an.*" on the ventral surface; this organ he describes as being filled with the white matter so abundantly found in the Malpighian vessels of many other Acarina, *e. g.* the Gamasidæ. Croneberg's view by no means agrees with the previously expressed opinions of Pagenstecher, who considered Croneberg's excretory organ to be the rectum, and characterized Dujardin's earlier suggestion that an *Acarus* might be without an anus as an excursion into the realms of fancy. Henkin found in *Trombidium* an arrangement similar to that described by Croneberg, but although he could not find any connection between the ventriculus and Croneberg's excretory organ he thought that there must be one and that the latter must be regarded as the hind gut.

Henkin says that where this organ overlies and touches the ventriculus, the investing membrane (or tunica propria) becomes vague, and that he thinks that there must be communication at this point, although he could not find it. After this came Schaub's paper on *Hydrodroma*: he described a very different state of affairs; he saw all that Croneberg and Henkin saw, and a great amount more; he agrees with Croneberg that the excretory organ which opens at the so-called anus does not communicate with the ventriculus; but he says that this opening is not the anus at all, but is simply the opening of the excretory organ, and that, in *Hydrodroma*, the same chitinous plate on the ventral surface which contains the so-called anus also contains a much smaller opening, immediately anterior to the other, which is the true anus; he draws and describes a well-developed hind gut leading from the ventriculus to this true anus in addition to, and quite separate from, the excretory organ. Schaub remarks correctly that previous writers had not observed this smaller opening, except Halder, who calls it a preanal opening[1], and only noticed it in *Hydrodroma*; he is inclined to object to former authors having called the larger opening the anus, and he suggests that it is scarcely probable that *Hydrodroma* is the only Hydrachnid which possesses an anal opening—a reasonable observation enough.

A year later Schaub published a very interesting paper on marine Hydrachnidæ, giving, *inter alia*, numerous anatomical details relative to two species of *Pontarachna*; but, oddly enough, in these he only draws a single opening which he calls anus, just as previous writers had in other species, without saying whether it was the point of discharge of the alimentary canal or of the excretory organs or of both.

Coming now to *Thyas* I find precisely the state of things described by Croneberg. I find a single longitudinal slit-like opening (figs. 10, 23, *A.*) closed by two labiæ and situated in a small chitinous plate (fig. 10, *ap.*) in the median line of the body about halfway between the epimera of the fourth legs and the posterior margins of the body. I have most carefully examined this plate and the surrounding parts in many specimens, and I cannot find any trace of a second opening such as Schaub describes; to this single opening one organ and one only goes; this organ is the excretory vessel described by all the authors, and its whole inner surface is usually thickly clothed with the white excretory matter before mentioned. There is not any second viscus such as that figured by Schaub; the ventriculus ends blindly (fig. 23, *v.*). The excretory organ overlies it in the central line, and even hides almost all of its azygous anterior diverticulum when looked at from the dorsal side; it then turns downward, passing through the large opening left by the hollow-square form of the ventriculus in this species, and goes to the opening before described. This organ certainly ends blindly in front, and although it overlies and touches the ventriculus for a considerable distance, yet I am utterly unable to find any sign of a communication between the two. There is not any point where the outer coat of the excretory organ becomes vague as in Henkin's *Trombidium.* I have carefully examined sections, cut in all directions, with high powers, and the tunica propria appears continuous and most distinct everywhere, and in some specimens the two organs do not quite touch anywhere, there being a distinct space between with connective tissue joining them. I know how difficult it is sometimes to detect communications, and therefore I will not absolutely deny that anything of the kind exists; but I am decidedly of opinion, however improbable it may seem, that it is true that the mid-gut ends blindly, and that the excretory viscus which ends in the anus-like opening (fig. 10, *A.*) has not any communication with the mid-gut. The improbability is diminished when we consider that these creatures do not swallow any solid food, but live entirely by suction, feeding on the blood of other minute creatures which they capture; still, of course, a Spider or a Gamasid lives in the same way, but has a distinct hind-gut and anus. In the present instance, however, I have not ever seen food in the organ, as we should expect to do if it were in direct communication with the ventriculus; I find the white excretory matter and that only.

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[1] "Die Arten und Gattungen der Schweizer Hydrachnidenfauna," Mittheil. d. Schweizer entom. Gesellsch. 1882, p. 18.

With regard to the homologies of the organ, if it were not for Schaub's species, I should say that it appeared to me that the anus-like opening was the true anus, and that the excretory organ which leads to it was the homologue of the hind-gut; although in consequence of the nature of the food, or for some other reason, the hind-gut had become severed from the mid-gut and had lost its function as a hind-gut, assuming that of the Malpighian vessels found in Gamasidæ, &c. I have not ever seen Schaub's species: but if we can rely, as we naturally suppose we may, upon his investigations, which I believe were conducted in Professor Cohn's laboratory at Vienna, then the presence in so closely allied a species of a second anal opening, and of a well-marked and functional hind-gut, in addition to the excretory organ and opening, would seem to prove beyond question that in other species, such as the present one, the hind-gut and anus have become obsolete, and that the excretory organ is of the nature of a Malpighian vessel, or at all events of the organs which bear that name, whether properly or not, in the Gamasidæ, &c, and in many other Arachnida, e. g. *Mygale*, &c., although it discharges to the exterior instead of into the hind-gut between the colon and the rectum, which is the point of discharge in Gamasidæ, &c.

The form of the excretory organ (fig. 15, and figs. 14, 23, *E.*) is very much that shown by Schaub, viz. an elongated sac with a rounded, cæcal, anterior extremity, varying and irregular in its diameter, but widening out so as to form a pyriform expansion before it suddenly narrows to reach its point of discharge. This widened part is generally compressed dorso-ventrally by folding and compression. These folds are quite irregular and do not always occur; when they do they are not usually bilaterally symmetrical, or probably in any way permanent; they often are found to a lesser degree in other parts of the sac, and evidently provide for considerable extension and contraction of the lumen of the organ. The folding sometimes is found in directions where it would probably not result from dorso-ventral compression.

In regard to the homologies of the alimentary canal and excretory organs, it may not be immaterial to remember that Wagner[1] has lately found that in the embryo *Ixodes* the so-called Malpighian vessels are formed from the endoderm quite separately from the proctodeum, and only become connected with that organ in the latest stage of development. The histology of the alimentary canal does not present any features varying sufficiently from what has been described by other authors to make it necessary to notice them. The tunica propria is particularly clear and well marked. The lumen of the ventriculus is large, its walls composed of more closely-placed cells, forming a more even layer than is usually found in the ventriculus of Acarina; the cells are large but not so loose nor rounded as in most species, and the large groups of rounded cells projecting into the lumen and gradually becoming detached and dropping off into it, correctly figured by Henkin in *Trombidium*, are far less abundant here. These remarks apply specially to the male, in which, as far as I have seen, the amount of food-material absorbed by, and contained within, the cells of the ventriculus is less than in the case of the female, where the cells are often greatly distended by it.

Salivary Glands (Plate VIII. fig. 16; Plate IX. fig. 23).

I use the expression "salivary glands" for the glands which I am about to treat of because that expression is in general use for them; I am not, however, satisfied that it quite correctly expresses their function.

These glands are often largely developed in the Acarina, probably most so in the predatory kinds. It is already well known that some species of Hydrachnidæ are amply provided with them; in the present species they assume considerable importance. Croneberg found three pairs of glands, each pair having bilateral symmetry, two pairs being more or less kidney-shaped, while the third pair are more sausage-shaped. Croneberg only draws and describes the portion of these later glands near to, and including, the efferent end, apparently not having traced them further. In his fig. 33 he draws the kidney-shaped glands as composed of numerous, largish, closely-pressed secreting-cells with clear nuclei, and the sausage-shaped glands as composed of a single layer of squarish cells surrounding a small lumen; he shows the three glands on each side of the body as communicating by small ducts with a larger joint efferent-duct. Schaub also found three pairs of salivary glands very similar to Croneberg's—two pairs which he calls kidney-shaped, and one which, following Croneberg, he properly calls pipe-shaped or tubular (schlauchförmig); this gland he says has its blind end fixed to a chitinous projecting piece or band arising from the anterior edge of the body near the side of the rostrum, and about the level of the top of the brain; the gland then runs nearly straight backward until it reaches a point about one-third of the length of the body (without rostrum) from the anterior edge of the body; the gland then makes several twists on itself, running across the body toward the median line, but not reaching it; then runs forward again, soon loses its twisted character, and approaches its point of origin, thus forming a nearly complete loop, and ends in a long fine duct running toward the mouth. Schaub was not able to trace this duct to its point of discharge, nor was he able to determine with certainty whether the two kidney-shaped glands and the tubular gland on each side join in a common efferent duct, as Croneberg says, or not; but he says that if they do, in his species, the juncture must be very near the mouth, as he has traced the three separate ducts a long way; he seems to me to doubt their joining at all. Croneberg describes a tubular salivary gland in *Trombidium* with a course very similiar to that given by Schaub[1]; and Pagenstecher had described it in 1860.

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[1] "Beiträge zur Phylogenie der Arachniden," Jena. Zeitschr. f. Med. u. Naturw. 29 Bd. (1894) Heft i. pp. 125–152.

In the present species there is a very decided resemblance to the condition described by Croneberg and Schaub; the general scheme of the salivary organs is undoubtedly homologous, but the whole thing is more elaborated and the differences in detail are numerous and of some importance; on the whole, Croneberg's species and description come nearer to *Thyas petrophilus* than Schaub's do. In the species which I am describing there are at least three pairs of salivary glands (I will explain later on why I use the expression "at least"), two of these are clearly the homologues of the kidney-shaped glands and one of the tubular gland. If the creature be opened on the dorsal surface, and the dorsum and fat-body and other surrounding organs be removed, it will be found that just anterior to, and a little to the side of, the brain is a gland which may fairly be described as reniform (fig. 16, *sgr.*); it represents the "larger dorsal mouth-gland" of Schaub, which it greatly resembles in general appearance; a very similar gland was described as long ago as 1860 by Pagenstecher (in *Trombidium*), although his details may not be quite correct, and in 1861 by Gudden in reference to the Tyroglyphidæ[2]. This gland in *Thyas petrophilus* is formed of large secreting-cells radiating almost from a centre: these cells have an exterior measurement of about ·02 mm., and a length, measuring from the exterior toward the centre, of about ·08 mm.; they have large, very clearly-marked

[1] "Ueber den Bau von *Trombidium*," Bull. Soc. Imp. d. Nat. de Moscou, 1879.

[2] "Beitrag zur Lehre von der Scabies," Würzburger medicinische Zeitsch. 1861, p. 301, and zweite vermehrte Auflage, Würzburg, 1863.

nuclei of about ·01 mm. diameter, usually placed very regularly, which are best seen in sections. The size and shape of the whole gland varies a good deal in different individuals, and probably at different times, but the average size may be considered to be about ·1 mm. by about ·07 mm. Although this is the larger of the two kidney-shaped salivary glands in Schaub's species it is not so in the present instance, the representatives of the other of the two being somewhat larger. This latter pair of glands (figs. 16, 23, *sgq.*) cannot be called kidney-shaped in the present species, each is more square with advancing rounded corners; they are not regular in shape, varying considerably in different individuals &c., still they preserve their general form; they are flattened dorso-ventrally, and lie rather further back than the kidney-shaped pair; they are pressed against one another in the median line; and their posterior portions overlie and hide the anterior part of the brain, when seen from the dorsal side. The average size of each of these glands is about ·11 mm. square. Simply for the sake of clearness I will speak of them in this paper as the "quadrate salivary glands." In spite of this general agreement in the form and position of these two pairs of glands with those described by Schaub and Croneberg, there is one leading point in which there is a very marked difference from them, and indeed from all similar glands yet described in the Acarina; and that is, that all the authors describe their glands, doubtless correctly, as discharging by a single duct; in the present species each of the four glands discharges most distinctly by two paired ducts (*dq.*, *dr.*): whether this indicates the original derivation of each gland from two which have coalesced, I am not prepared to say; they do not show any other signs which I can detect of a double origin; but the two ducts are clear and unmistakable. In the kidney-shaped glands the ducts spring from opposite sides of the gland a considerable distance apart; they are largest in diameter where they leave the gland (about ·01 mm.) and gradually diminish, their smallest part being where they enter the main general duct (there they are about ·004 mm.) (fig. 16, *dr.*). The two ducts from each quadrate salivary gland (fig. 16, *dq.*, fig. 21) spring from the underside of the gland near its anterior edge; they arise some small distance apart, but considerably nearer together than those from the kidney-shaped gland; they are also much finer and more transparent than those from the last-named gland, and enter the main general duct together, joining just before they enter. They often overlie one another; thus while it is perfectly easy to see the two ducts from the kidney-shaped glands, it requires very careful dissection to demonstrate those from the quadrate glands; one of these must be dissected off, turned over to expose the under surface, and the two ducts separated with a very fine hair: if this trouble be taken then the two ducts are perfectly apparent, and their whole course may be traced to their entrance into the main general duct. I now come to the tubular salivary glands (fig. 16, *sgt.*); these, although essentially "tubular glands" are very different from, and much more complicated than, those described by Schaub and partially described by Croneberg. In the first place, instead of their blind distal end being attached near the mouth it is attached to the side of the body about halfway back and opposite the genital organs: the gland is not in any way bent into a loop; its direction is forward for its whole length, but it is greatly and irregularly corrugated and twisted for about two-thirds of its course; in this part it has an average diameter of about ·02 mm., is a fleshy organ composed of largish secreting-cells, and has a very small lumen. The gland suddenly narrows at the end of this portion, loses its twisted and corrugated form, and becomes straight; it is still somewhat fleshy in appearance, and has a diameter somewhat less than half the diameter of the corrugated part; its largest diameter is in the centre, and it narrows at both ends to about half the diameter of the centre. This tract of the gland may be considered as the duct; it is usually filled with small round granules (secreted matter), very similar to that spoken of by Schaub in the distal portion of his tubular gland and by Croneberg in the same portion in *Trombidium*; except that, in consequence of the larger diameter of the organ now being described, the granules do not follow each other in single file as they do in Schaub's drawing. After this portion the duct suddenly expands again and becomes a large transparent ovate bladder, with thin, apparently structureless walls (fig. 16, *sb.*). The diameter of this bladder in its widest part is larger than that of any other portion of the whole duct; at its anterior end it narrows sharply, and there is a very short tubular part which turns suddenly downward and backward to join the main general duct. This description is not taken from a single specimen, all the numerous specimens which I have dissected have been alike. The only record at all resembling this bladder is Pagenstecher's respecting *Trombidium.*

It now remains to describe the precise manner in which the various glands above described communicate with the common duct (main general duct). There is one of these common ducts (*D.*) on each side of the body, and all the three salivary glands on that side communicate with it; it is of an almost uniform diameter until near its posterior end, where it enlarges somewhat suddenly both in a lateral and in a dorso-ventral direction; the small anterior end or prolongation of the bladder of the tubular gland enters the common duct in the middle line of the upperside of this enlargement, and the two ducts from the reniform gland enter the lateral edges of its upper part, one on each side. The two ducts from the quadrate salivary gland enter the tubular part of the common duct close together some distance nearer to the mouth than the entrance of the ducts from the reniform glands. At the posterior end of the lower part of the enlargement of the common duct, another tube (*du.*), which at its starting point is of nearly as large diameter as the tubular portion of the common duct but rapidly diminishes and becomes very fine, runs at first backward and then almost perpendicularly downward. I have not been able to ascertain with certainty whether this tube ends blindly or is the duct of a fourth salivary gland; my opinion is that the latter is correct and that the tube is a fine duct coming from a small roundish gland lying close to the reniform gland. It is for this reason that I say above "at least three pairs of salivary glands," but as I have not been able to trace the communication with certainty I have thought it best not to draw this gland. The common duct runs to the upper surface of the chitinous bridge or lamella which is joined at its edges to the inner sides of the maxillary lip and forms a chitinous endo-skeleton in the rostrum upon which the mandibles rest. The commom duct penetrates this chitinous bridge, and runs forward for a short distance practically within its substance; the duct terminates by a bell-shaped mouth (*db.*) on the underside of the chitinous bridge.

In addition to the paired glands above described, there is an azygous sausage-shaped gland (fig. 23, *asg.*) practically in the median line of the hind part of the rostrum. It is about ·11 mm. long, with a diameter of about ·02 mm., is a fleshy organ with an extremely small lumen, and lies between the paired fan-shaped groups of muscles which run from the sigmoid piece to the mandibles (see page 203). The duct from this gland is short and fine, and runs straight forward towards the buccal chamber.

I have said above that I doubt whether there is sufficient evidence to justify us in asserting positively that the function of all these various glands is salivary only.

The Male Genital Organs (Plate VIII. figs. 17, 18; Plate IX. figs. 23, 28).

The male reproductive system differs in a remarkable degree from anything which has, to my knowledge, been hitherto described among the Hydrachnidæ, or, indeed, in any of the allied families. Schaub, for instance, in his species found a group of five pyriform testes on each side discharging by a common duct, which duct joined with its fellow from the opposite side to form a short unpaired duct leading into a long, much convoluted, duct, which he calls the vas deferens: this terminated in a short penis surrounded by muscles. Croneberg's *Eylais* shows a complicated network of testes entirely unlike anything found in the present species. Probably the nearest described organs are those of the species of *Trombidium* figured by Croneberg in his later work, 'Ueber den Bau von *Trombidium*'; but even these present most material differences from the form I am about to describe.

In *Thyas petrophilus* there is, on each side of the body, what appears to be a large testicular mass (figs. 17, 28, 23, *T.*), which immediately underlies the lateral portion of the ventricular ring. This testicular mass has an average length in fully-formed specimens of about ·3 mm., by a thickness in a dorso-ventral direction of about ·17 mm. in its thickest part. This mass is comparatively flat on its under (ventral) surface, and comparatively, although not quite, straight on its inner side; but it is formed into two lobes by the swelling and rounding of its dorsal and lateral surfaces both anteriorly and posteriorly, leaving a thinner and narrower portion between, but without any breach of continuity or line of demarcation; the whole forms one piece. The mass varies a good deal in form in different specimens, and even the two sides of the same individual are seldom quite similar, but the general shape always corresponds fairly well. The masses on the two sides of the body are a short distance apart anteriorly, but approach each other closely posteriorly: almost at their hinder ends they are joined by a short bridge (fig. 17) quite continuous with both sides, so that the organ on both sides of the body forms one unbroken whole. From the ventral surface of the narrower part of the testicular mass on each side proceeds a vas deferens of moderate length, which runs upward and forward. At its anterior (distal) end, which is nearest to the dorsum, this vas deferens joins its fellow from the opposite side of the body, and the two enter a short widish ductus ejaculatorius (figs. 17, 18, 23, *de.*) with very fleshy walls, which runs downward and a little forward. This organ is inversely pyriform, being narrowed at its distal end so as to discharge by quite a small opening into a very large penial canal (figs. 18, 23, *pc.*), which again is inversely pyriform, its largest part being near to where the ductus ejaculatorius enters; this canal proceeds almost perpendicularly downward. On the outside of the widest part of the canal is a chitinous bar (fig. 18, *cb.*), from which a series of diagonal muscles (fig. 18, *mc.*) spread out; so that those on the two sides of the body, acting simultaneously, would form powerful compressors. Longitudinal muscles also run from the ductus ejaculatorius to the inner side of the cuticle of the body close to the genital opening; thus the penial canal can be compressed longitudinally as well as transversely. The canal itself is a large, membranous, tubular organ, considerably and irregularly folded, so that the portion nearest to the ductus ejaculatorius is apt to form a series of pouches, and the more distal part a number of longitudinal folds converging to the genital aperture. This last-named part is not much hidden by muscles when the organ is dissected out, whereas the more bulbous proximal portion is almost surrounded by them. I have not been able to discover any chitinous penis such as Croneberg draws in *Trombidium*. The penial canal, as I have drawn and described it, is as at rest under ordinary conditions. I have not been able to examine it at the moment of coition, and therefore I am not able to say whether the membranous tube is evaginated—thus, in effect, forming a penis, which seems very probable,—or whether the sperm is simply deposited on the exterior of the female, or conveyed by the feet as observed by Koenike in *Curvipes fuscatus*.

The testicular mass appears to be one solid block (subject to the foregoing description of its shape), and there is not any line of demarcation or any membrane or division between its various parts; but still it is not really so. The greater part of it has an external coating of a single layer of large cells about ·015 mm. in diameter, having very distinct nuclei of about ·004 mm. and nucleoli of about ·002 mm. (fig. 28). On the outer and upper part of the anterior region of the front lobe and the outer and upper part of the posterior region of the hind lobe, on each side of the body, this layer, although existing, is less distinct and regular; the cells are somewhat smaller and more broken; but on their inner side in these localities will be found two or three layers of much larger polygonal cells (*sm.*), often as large as ·04 mm., in which the nucleus cannot any longer be detected: these cells are the true sperm-mother-cells, and are usually crowded with spermatozoa in various stages of maturity according to the age of the cell. The spermogenous cells of the inner of these layers, when quite mature, burst and discharge their contents into the interior of the organ, which, although having the appearance of a solid mass, is seen when examined with a sufficient amplification to be a hollow viscus closely packed with sperm and secretion; thus the whole organ forms a combination of testis and vesicula seminalis. It is a sac, the walls of which are formed of a single layer of large cells, which give birth to the true spermogenous cells on their inner surface at certain parts of the sac. These sperm-mother-cells discharge their contents into the interior of the sac, which becomes so full that the lumen of the sac is obliterated and the whole appears like one solid mass. It is probable that the contents are mixed with other secretion, but I do not detect special accessory glands. In the vasa deferentia the cellulation of the walls becomes indistinct, and there is a slight tendency to corrugation; but in the ductus ejaculatorius we again find the wall composed of distinct fleshy cells with clear nuclei, similar in character to those composing the outer layer of the testicular sac but smaller. The penial canal is a thin and almost structureless membrane.

The Female Genital Organs.

These organs so closely resemble what has been before described by Schaub, Henkin, and others, that it is not necessary to say much about them. The ovary forms a flattened ring with two oviducts leading to an unpaired canal (the vagina) as in the described species; and, as in these descriptions, the eggs are formed upon the upper surface of the ring: the only observations which it seems desirable to make are, firstly, that the ova in *Thyas petrophilus* are not quite so strictly confined to the upper surface as in the other recorded species of Hydrachnidæ; in the main part of the ring they are so confined, but in the rear part and near the insertion of the oviducts they are formed on the edges, and even on the under surface as well as the upper. Secondly, that although in the nymphs and young adults the ring form of the ovary is conspicuous, the ring being open and dorso-ventral muscles passing through it, yet that in the adult, when the eggs are mature, they are so numerous and crowded on the inner edge of the ring, that, being matured in pedunculated oocysts, they fill up the whole interior of the ring and cause it to look like a disk; although, of course, it really remains a ring in structure, and the muscles continue to pass through the mass of eggs just as they did through the ring. Thirdly, that there are a considerable number of fine and short contorted tubes, apparently of a glandular nature, surrounding the outer edges of the ovary, the exact course and connections of which it is extremely difficult to make out, which have not been mentioned by former investigators; they are apparently outgrowths and plications of the peripheral parts of the ring itself, and possibly function as accessory glands.

The (so-called) Genital Suckers (Plate VIII. fig. 19).

In some families of Acarina the external genital aperture is accompanied by the organs which are known by the name of "genital suckers." In the Oribatidæ and Tyroglyphidæ they lie actually within the genital opening, and are only exerted when in action or by means of pressure. They are, in these families, soft extensible organs, usually either two or three pairs, and certainly have the appearance of suckers. In the Oribatidæ they are of somewhat complicated structure[1], and are the only sucker-like organs on the body. The mode of coition of the Oribatidæ is not known; but these organs have been considered to be genital, *i. e.* copulative, suckers by Claparède[2], Nicolet[3], and others. In the Tyroglyphidæ they have been considered to fulfil a similar office by Fumose and Robin[4], and Nalepa[5]; but in these creatures the mode of coition is known, and it takes place by a bursa copulatrix at the anal end of the female. The male during coition is above, not below, the female; so that the supposed copulative suckers of the female cannot possibly touch the male during coition; and in most species the male only, in addition to these so-called genital suckers, is provided with a pair of what certainly are copulative suckers, placed near his anal end. These considerations, *inter alia*, led Mégnin[6] to deny entirely that these organs were suckers. He says that he has watched them in action, and that it is at the moment of the deposition of the egg by the female that they are exerted, and that they then guide the egg. Mégnin admits that this does not explain their presence in the male; he says that he has not ever seen them in action in that sex, but he suggests that they probably serve to break the adherence of the male and female after the termination of the coitus. The principal objection to Mégnin's view as to the female would appear to be that in the Oribatidæ, which possess precisely similar organs, there is a long extensible ovipositor through which the egg passes; so that it could not possibly be touched or guided by these "genital suckers."

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[1] 'British Oribatidæ,' by the present author. Ray Soc. 1883, vol. i. pl. F. fig. 11.

[2] "Studien an Acariden," Zeit. wiss. Zool. 1868, p. 511, taf. xxxvii. fig. 5 *b b*.

[3] "Histoire Naturelle des Acariens qui se trouvent aux environs de Paris" Archiv. du Muséum, t. vii. p. 415.

[4] "Mémoire sur les Acariens des genres *Cheyletus*, *Glyciphagus*, et *Tyroglyphus*," Journ. de l'Anat. et de la Physiol. (Robin's), 1867, pp. 591–592.

[5] "Die Anatomie der Tyroglyphen," Sitzb. k. k. Akad. Wien, 1885, p. 16.

[6] "Mémoire sur les Hypopes," Journ. de l'Anat. et de la Physiol. (Robin's), 1874, pp. 239–240.

Organs which must be homologized with and which greatly resemble these so-called genital suckers exist in the Hydrachnidæ, and are greatly developed in the genus *Hydrodroma*. They were noticed by Neuman[1] and Haller[2]. The latter, although he calls the organs suckers (Haftnäpfe), generally puts the word between quotation-marks, as if he did not wish to be responsible for the name. He pointed out that in this genus these suckers, although somewhat extensible, were externally convex chitinous knobs, and he gives a rough drawing of the chitinous parts. Schaub, in the work so often quoted (p. 46), describes two pairs of such organs, which he terms the "so-called suckers," and one pair of chitinous rings which he regards as true suckers. These last-named pair are on the membranous folds or labia, which are situated between the genital plates and border the genital opening; the two pairs of convex chitinous knobs are at the anterior and posterior ends of the genital plates themselves, not forming one piece with the plate, but each knob is described as capable of protrusion, and as being a hollow hemisphere with its convex side on the exterior of the body, *i. e.* downwards, and with a short thick bundle of striped muscles inserted into its concave or inner side, and practically filling the hemisphere. Schaub says that the position and arrangement of these muscles leaves no doubt that the organs subserve copulation.

In *Thyas petrophilus* I find three pairs of these so-called suckers—two pairs in the labia between the genital plates, and one at the posterior angles of the plates, all slightly, but only slightly, protrusible; in each case the plates are excavated to allow these organs to pass. The posterior pair are rather the largest, but in other respects all three pairs are alike; there is not any ring-like sucker as in Schaub's species. Each so-called "sucker" (I use the expression for want of a better one) is provided exteriorly with a strong hemispherical cap of homogeneous chitin, with the convex side to the exterior, as in Schaub's species; the chitin covers the whole exterior of the organ, is about ·004 mm. thick and of a light reddish colour (fig. 19, *cm.*). This chitinous cap is supported by an irregular-shaped band of thicker chitin of a clear yellow colour standing at right angles to the cap: this chitinous band is attached to the soft cuticle of the ventral surface of the body, and forms the margin of an opening in the cuticle which just allows the narrowest part of the organ to pass through it, both the cap and the inner part of the organ being larger than the opening. Thus in the chitinous cap and the external appearance and position the organs in my species fairly correspond with those described by Schaub; but here the resemblance suddenly ceases: instead of the large simple bundle of striped muscles filling up the interior of the cap and arising from the other genital organs, we have an entire absence of muscles within the cap, although some small muscles are attached round it. The inner side of the chitinous cap rests upon the distal ends of a number of columnar radiating cells forming an even layer about ·016 mm. thick; these cells take stain very deeply and rapidly, so much so that it is difficult to prevent their staining too darkly if other parts are to be stained at all. The proximal ends of these cells rest upon a basal membrane (*mb.*) about ·003 mm. thick, which does not stain at all, and which is continuous with the external membrane of a solid pyriform mass of large elongated cells. Each cell is largest at its inner extremity and diminishes outward. All the cells converge toward the smallest part of the organ, *i. e.* the point where it passes through the hole in the cuticle; they then spread out again a trifle, and their distal ends abut on the inner side of the basal membrane before mentioned; the distal portion of each cell, *i. e.* the part between the hole in the cuticle and the basal membrane, stains darkly and rapidly; the rest of the cell much more slightly and slowly. Each cell near its larger (inner) end contains a large clearly defined nucleus with a distinct nucleolus, those in the respective cells being very regularly arranged.

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[1] "Om Sveriges Hydrachnider," Stockholm, 1880, Kongl. Svensk. Vetenskaps-Akad. Handling., Band. 17, No. 3, p. 112.

[2] "Die Hydrachniden der Schweiz," Mittheil d. Bern. naturf. Gesellsch. 1881, Heft ii. p. 48 (1882).

The whole organ has a formation entirely different from what would be expected in a sucker, and indeed has much more the appearance of a sense-organ of some kind; *e. g.* it looks not unlike the simple ocellus of an insect. I do not for a moment suggest that such is its function; such a thing would be unlikely in the extreme; and I do not detect any sufficient nerve-supply to justify it if it were not; but I do suggest that, in this species at all events, the organs are not suckers, and that it seems not impossible that they may have some sensory function. It struck me at first whether they could be glandular, but I do not find any point of discharge, nor any signs of cells breaking down and emitting their contents; and it has to be remembered that they are present equally developed in both sexes. Of course I at once admit that the position of the organs is such as to render it most probable that they perform some office in connection with the genital organs.

Glands of unknown Function (Plate IX. fig. 28).

Lying immediately below the lateral portions of the hollow square of the ventriculus, immediately above the genital organs in both sexes, and about the middle (longitudinally) of the latter organs, exist a pair of almost globular, or slightly elliptical, organs of about ·04 mm. diameter in the male and about ·05 to ·1 mm. in the female. These organs (fig. 19, *gu.*) have every appearance of being glands; they are composed of distinctly-nucleated closely-packed, elongated cells of about ·01 mm. diameter, and in section exhibit similar cellulation all through; they are quite solid without lumen; but I have not been able to trace any duct from them. I thought at one time that they probably discharged into the posterior part of the tubular salivary glands; but after careful investigation I am not, up to the present, able to state that this is the case, although the two organs are in tolerably close juxtaposition; and the function of the glands therefore remains uncertain to me.

The Palpal Organs (Plate VIII. fig. 22).

These organs might probably be included in the last section as glands of unknown function, but I do not wish to pledge myself to the assertion that they are glands, although I incline to think so. They are largish paired organs, one on each side of the body; the posterior portion is an elongated lobe with a rounded hinder end; about a third of the length of this lobe (the posterior third) lies under the brain, but is not in any way connected with it, there is a separate nerve from brain to palpus. The lobe runs in an almost direct course from below the brain to the palpus, but it diminishes considerably in diameter before reaching that appendage, and where it enters has less than one third of the diameter of the thickest part of the lobe. Within the first joint of the palpus the palpal organ swells out again and forms a second elongated lobe, not nearly so thick as the first; at its distal end this bends slightly downward, and enters the second joint, where it again diminishes in diameter, and then runs forward until nearly the distal end of the palpus, keeping an almost uniform thickness (the anterior part is not shown in the figure). The organ is composed of large irregularly-placed cells, as far as can be judged from the nuclei, which are few but very distinct and of considerable size; but I have not been able to detect the lines of demarcation between cell and cell in any of my preparations.

The organ is solid, *i. e.* there is not any lumen, and I have not been able to trace anything like a duct from it. I am not aware of anything which has been described in the Acarina which can be identified with it or considered the homologue of it; nor have I ever seen such an organ in any other species that I have examined: the structure most resembling it, that I am acquainted with, in the Acarina is the spinning-gland partly in the palpus of *Tetranychus*; but the present species is aquatic and there is not any reason to suppose that it has any power of spinning; moreover the palpi are not furnished with a spinneret, such as is found in *Tetranychus*. The palpus is almost certainly a raptorial organ, it assuredly is not tactile; but there is not any poison-fang or spine that I can discover, and the mandibles are evidently the killing-organs. For these reasons I think it best not to suggest a function for these palpal structures and to leave the matter for future investigation.

The Nervous System (Plate VIII. fig. 20; Plate IX. figs. 23, 27).

I do not know that upon this part of the anatomy I have many observations to describe relative to the present species which differ in very important matters from what has been before observed by other acarologists in various species; but still I think that there are some new points of considerable interest to be detailed; and moreover, as former anatomists have not been altogether agreed as to the distribution of the nerves, fresh investigations may be useful, although made upon different species, or even families.

The great central nervous mass in all Acarina which have been investigated is the so-called brain (*br.*); which is penetrated by the œsophagus, that organ passing right through it, generally in a more or less oblique direction, and being accompanied by tracheæ in the present species. Although the whole of this brain is one mass, yet its formation from a supra-œsophageal and a sub-œsophageal ganglion is usually fairly apparent; the latter frequently extending considerably further backward than the former. In the present species the distinction between the upper and lower ganglia is practically lost; the whole forms one almost, but not quite, globular mass (figs. 20, 23, *br.*) which, in the male, has a diameter of about ·13 mm. in a dorso-ventral, and of about ·1 mm. in an antero-posterior direction; it lies considerably nearer to the ventral than the dorsal surface, indeed its lower edge nearly reaches the ventral cuticle. This brain is situated about as far back as the second pair of legs; it lies below the salivary glands, and in front of the genital aperture, and is invested by a most distinct neurilemma, which is separated from the nervous substance by endosmosis if the organ be soaked in water. The œsophagus (figs. 20, 23, *œ.*) penetrates the brain in a slightly oblique direction, running backward and a little upward.

From just above the œsophagus there starts from the lower part of the supra-œsophageal portion of the mass a fine, central, azygous nerve (*nph.*), which runs almost parallel to, but a little above, the œsophagus for the whole length of that organ; it then splits up into a large number of separate twigs, one of which runs to each muscle of the sucking-pharynx. About this nerve I do not feel any doubt whatever; I have it in several preparations, and in one fortunate sagittal section of the creature I have the whole length of the nerve from the point where it issues from the brain to its ultimate distribution to the pharyngeal muscles. A precisely similar nerve has been figured by Henkin (*op. cit.* fig. 7) as existing in *Trombidium fuliginosum*. Winkler[1] has drawn a similarly placed nerve in *Gamasus*, but I imagine that he considers that it goes to the lingula, as he calls it the "Zungennerv"; he however identifies it with Henkin's.

Schaub does not mention any such median nerve as going to the pharynx, but he does mention a median nerve which he says goes to a central unpaired eye which he seems to have found in *Hydrodroma.* Croneberg says that the pharynx in *Eylais* is innervated from the first pair of nerves from the supra-œsophageal ganglion, which also supply the mandibles: this certainly is not the case in *Thyas petrophilus*; although, as will be seen below, I think that the mandibles are supplied much as Croneberg says.

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[1] "Anatomie der Gamasiden," Arbeit. d. zool. Ins. Wien, vii. p. 336, taf. iii. fig. 8 (1888).

It is very difficult to trace the finer nerves in the Acarina and to be certain that one has traced all that start from the brain, although the larger ones, such as the great nerves to the legs, are easily followed; but to the best of my judgment I have been able to trace, in addition to the azygous nerves, 4 pairs which arise from the supra-œsophageal portion of the mass, 1 pair which arise exactly on the level of the œsophagus but considerably to the side of it, so that I cannot say whether they are supra- or sub-œsophageal, and 5 pairs of large nerves, from the sub-œsophageal portion of the mass.

The first pair from the upper ganglion are a thin pair of nerves (fig. 20, *nm.*) near to the median line, and they appear to me, in the present species at all events, to supply the mandibles only—not the mandible and pharynx, as Croneberg says they do in *Eylais.* Schaub states that the mandibles in *Hydrodroma* are innervated by the same nerves as the palpi; this does not seem to me to be the case in *Thyas petrophilus.* As regards homologies in other families of Acarina, Winkler, in the Gamasidæ, where the mandibular nerves are conspicuous, found that the mandibles were innervated by special nerves not identical with those serving the palpi, and fairly corresponding with the pair I find in *Thyas*, although situated a little further back, which may probably be accounted for by the great retractility of the mandibles in *Gamasus.* Nalepa found the mandibles of the Tyroglyphidæ to be innervated by special nerves, different from those serving the palpi, and agreeing in position with those I am now describing. Henkin also apparently found the same thing in *Trombidium fuliginosum.*

The second pair of nerves from the supra-œsophageal portion of the brain arise somewhat from the dorsal suface of that organ; they are an extremely thin pair (fig. 20, *nv.*) and innervate the muscles which run from the dorso-vertex[1] to the maxillary lip and possibly other dorso-ventral muscles.

The third pair of supra-œsophageal nerves spring from nearer to the anterior edge of that region of the brain and are the large optic nerves (fig. 20, *no.*). These have been well described and figured by Schaub; they are long and large nerves, each dividing dichotomously near the distal end, and sending one branch to each of the two eyes on that side of the body, which are pressed so closely against each other as to appear like one double eye.

The only difference of any importance which I have found between Schaub's description and *Thyas petrophilus* is that he shows two fine branches as springing from the optic nerve some time before the final division into two; I find three such branches quite plainly visible in dissections. Schaub says that these branches go to sense-organs in the dorsal shield; I have not been able to find such sense-organs in my species, which has not the peculiar dorsal plate of *Hydrodroma* in which they are situated, and I have not been able to trace where the three fine branches in my species go to: I have two or three dissections showing the whole course of the optic nerve from the brain to the eye, and showing these branches for some distance; but I have not been able to trace them to their destinations and I cannot follow them in the sections.

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[1] The dorsal exoskeleton of the posterior part of the cephalothorax.

The fourth pair of nerves from the upper ganglion is a pair of very thin nerves from near the posterior edge of the brain (fig. 20, *nu.*), and which lie above and between the nerves serving the fourth pair of legs and the genital nerves: these nerves are extremely fine and difficult to trace, but are certainly present; I have not succeeded in ascertaining what organs they innervate.

The pair of nerves which proceed from the level of the œsophagus, so that it is hard to say whether they are supra- or sub-œsophageal, are shown at fig. 20, *np.*; they are long and substantial nerves and I have sections showing them well in their entire length. Each nerve, shortly after leaving the brain, forms a ganglionic swelling and then diminishes to its former size: about halfway between the brain and its destination it sends a very small branch downward; I have not been able to trace this to its destination. Some distance from its termination the principal nerve divides dichotomously, sending one branch (*np.* 1) forward and upward to the palpus, and the other (*np.* 2) forward and downward to the maxillary lip; a short distance before reaching which it forms a small ganglionic swelling.

This nerve is probably homologous with Schaub's nerve "ant," which he says serves the palpi and mandibles; of course this may be so in his species, but as the palpi are maxillary palpi and the maxillary lip in Acarina is formed of the fused maxillæ, the distribution to palpi and maxillary lip seems more what might be expected than that to palpi and mandibles. Schaub considered that the palpi were innervated from the supra-œsophageal; Croneberg from the sub-œsophageal ganglion. Nalepa (in *Tyroglyphus*) considered that the maxillæ were served by the sub-, and the maxillary palpi by the supra-œsophageal ganglion. In the present species it is, as before stated, impossible to say which ganglion the nerve belongs to.

Of the nerves clearly proceeding from the sub-œsophageal part of the brain-mass there are, firstly, the four pairs of great nerves proceeding to the four pairs of legs (fig. 20, *n* 1, *n* 2, *n* 3, *n* 4); as to the existence and position of which all writers are agreed; but all have hitherto described and figured them as unbranched nerves, at least no one has described any branches, although their existence might be anticipated; it will be seen by fig. 20 that I find more than one branch to each leg of the two hind pairs, in the fourth leg in particular I find several branches.

Croneberg, Schaub, and Nalepa all found that each of the four leg-nerves on each side of the body was accompanied by a much smaller nerve running parallel to it, which they call the accessory nerve; they all describe and figure it, doubtless correctly, as springing from the brain itself. In the present species the arrangement is very different; in the first two pairs of legs these accessory nerves exist (fig. 20, *na.*), and may be plainly seen in dissections although they are small and fine; but *they do not spring directly from the brain* as in the cases observed by those authors: they spring from the respective principal leg-nerves a short distance from the brain, and are in fact the first branches of those nerves; indeed the only ones which I have traced, although probably others exist in the more distal parts of the principal nerve. The two hind pairs of legs are entirely without accessory nerves, either springing from the brain or from the principal nerves. It is true that branches a good deal like the accessory nerves in character spring from the principal nerve much further on its course (fig. 20, *n* 3, *n* 4), but they are so very much further away from the brain than the branches of the nerves of the two first pairs of legs, that they can hardly be considered the homologues of the accessory nerves; moreover these branches are paired, not azygous as the accessory nerves are. No one has traced the accessory nerves to their destination or offered any explanation of what they are. It seems to me that the present species probably affords the key to this problem; they are apparently really branches of the principal nerves, which, in the species described by Croneberg and others, and probably in the majority of allied species, have for some reason gradually come to spring more and more closely to the brain until at last they have ended by springing from the brain itself and not from the principal nerve at all.

The last pair of large nerves springing from the lower ganglion are a pair quite at the rear and near the median line (fig. 20, *ng.*), which innervate the genital organs; practically all authors are agreed upon this point. In the present species I find that the principal trunk of the nerve runs to the dorsal side of the genital apparatus, and there gives off numerous fine branches to the various parts; and also sends a large branch to the vagina or ductus ejaculatorius and penial canal, as the case may be, and the muscles which surround it; and this branch divides, sending secondary branches to the so-called genital suckers. The principal branch forms a distinct ganglion, from which the fine nerves that are distributed to the organs actually arise; and there are at least one or two small ganglia in connection with the larger trunk. The existence of such ganglia has been already indicated by Schaub and even by Pagenstecher in 1860. The branches from this genital nerve are very numerous, and I am not prepared to deny that some of them may serve other organs not belonging to the genital system.

Besides these paired nerves there is a fine azygous recurrent nerve in the median line (figs. 20, 23, *nr.*) running below that portion of the œsophagus which lies between the brain and the ventriculus, and innervating the latter organ, or at all events the ventral surface of it.

The histology of the great nerve-centre does not appear to me to differ sufficiently from what has been described to need remark; the principal point which attracts attention is the great thickness of the structureless neurilemma, below which is a single layer of the usual small round cortical cells coating the fibrous material of the brain, but much less conspicuous than is generally the case in Acarina.

The Respiratory Organs (Plate VIII. fig. 21; Plate IX. fig. 23).

These do not vary very greatly in the present species from what has been before described; there are, however, some points worth recording.

The system is strictly tracheate, and the tracheæ are very numerous, very fine, and mostly unbranched or but little branched; it is bilateral. As is usual in the Hydrachnidæ hitherto examined, what may be considered as the central air-chamber on each side of the body is a somewhat **S**-shaped piece of chitin which I will call the "sigmoid piece" (figs. 21, 23, *sp.*); it is not, however, truly **S**-shaped in the present species, the lower half of the **S** being much more developed and curved than the upper. This piece of chitin is flattened laterally, and the two pieces are very near each other and consequently very near the median line of the body, one being on each side of the line, each is nearly at right angles to the mandible on its own side; the chitinous tube of the mandible is sharply cut away on its inner side about two-thirds of its length from the anterior end, leaving an oval hollow at the inner posterior third of the mandible into which muscles, tracheæ, &c. pass. The chitin of the mandible forms a concavity which rests upon the head of the sigmoid piece, which thus forms a fulcrum upon which the mandible works. From the concave side of the lower and hinder portion of the sigmoid piece arise five broad fasciæ of muscles (fig. 21, *mlm.*) arranged in a fan-shape; each fascia is attached to the sigmoid piece by numerous very short tendons similar to those attaching the pharyngeal muscles to the roof of the pharynx, but shorter. The five fasciæ converge and are inserted into the inner edge of the hind (cut away) portion of the mandible, each fascia being attached by more than one tendon; these tendons are less numerous, but slightly longer, than those at the sigmoid end. When these muscles contract they depress the posterior end of the mandible, and consequently raise its anterior end and claw, which, as will be noticed in figs. 21, 23, is set with the point upward; they therefore form the levator muscles of the mandible. The sigmoid piece is attached, by a strong ligament (fig. 21, *L.*) which rises from a projection near the middle of its anterior edge, to the chitinous bridge or shelf (fig. 21, *B.*) on which the mandibles rest; thus the action of the fan-shaped muscles cannot pull the sigmoid piece out of position.

Forming a fulcrum for the mandibles and a point of attachment for their muscles is not the only office of the sigmoid pieces; each is hollow and its interior is an air-chamber (*ac.*); it is lined by a thin loose membrane, which is in fact a continuation of the main tracheal trunk from the stigma; thus the air-chamber apparently varies in shape according to the amount of air which it contains for the moment: it, however, really occupies almost the whole interior of the sigmoid piece, and is broadest about the middle; it does not, however, extend to the upper (anterior) end and it diminishes to a very fine tube in the lower (posterior) curve of the **S** and ends blindly some distance before the point of this portion of the chitin.

There are two passages out of this air-chamber, one is situated in the posterior edge of the sigmoid piece near to but not at its upper (anterior) end; through this opening passes the principal tracheal trunk (fig. 21, *tra.*) which runs to the stigma (*S.*). This trunk is the only trachea in the body in which I have been able to detect any ringing, but here it is very distinct; it at first rises between the mandibles, but when it has reached their upper edge it turns forward, and runs above and parallel to the mandible on its own side for about one-fourth of the length of that organ; it then enlarges to a small bulb, pointed anteriorly, which contains the stigma (*S.*).

The second passage (*tre.*) out of the air-chamber is smaller and is placed in the upper edge of the projection from the middle of the anterior edge of the sigmoid piece to which, as before stated, the ligament (*L.*) is attached; a small branch of the air-chamber leads to this opening; out of which passes the efferent tracheal trunk, which shortly divides dichotomously, sending one trunk forward and one backward, which almost immediately breaks up into a multitude of extremely fine and delicate tracheæ which supply the body.

In addition to an arrangement practically almost similar to this Schaub describes and figures (see his Taf. iii. fig. 8, *tr.*) a number of very fine tracheæ passing direct into the air-chamber through the chitin of the sigmoid piece, and not springing from any tracheal trunk. I cannot say what there may be in *Hydrodroma*, but I can say with some confidence that nothing of the kind exists in *Thyas petrophilus*. I have several times obtained precisely the appearance figured by Schaub; but this, in the species I am describing, has certainly arisen from the fan of muscles being torn or cut away, leaving the numerous tendons by which they were attached behind them; these tendons part from the muscle much more readily than from the sigmoid piece.

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EXPLANATION OF THE PLATES.

Lettering.

A. Anus (so-called). It is really the orifice for the discharge of the excretory organs only, not apparently of the alimentary canal.
ac. Air-chamber; this is the hollow within the chitinous sigmoid piece.
ap. Anal plate.
ar. Areolations in the larger chitinous plates.
B. Endoskeletal "chitinous bridge" forming the floor upon which the mandibles run, and also forming a rigid base of attachment for the outlet of the salivary ducts and for the ligament from the sigmoid piece.
br. Brain.
C. Cuticle.
cb. Chitinous bar forming a base of attachment for muscles.
cc. Clear yellow chitin.
cæ. Anterior (azygous) cæcum of the ventriculus.
cm. Chitinous external tunic of genital sucker, convex exteriorly (meniscus-shaped).
cp. Chitinous areolated plates in the cuticle (larger kind).
cs. Chitinous plates in cuticle more finely and regularly perforated (smaller kind with hair).
ct. Connective tissue.
D. Common duct of the three salivary glands (so-called) on one side of the body, viz., the quadrate, the reniform, and the tubular salivary glands.
db. Bell-shaped mouth of same.
de. Ductus ejaculatorius.

dg.	Dermal glands.
dq.	Ducts from the quadrate salivary gland.
dr.	Ducts from the reniform salivary gland.
du.	Ducts believed to lead from a small fourth gland.
E.	Excretory organ.
ec.	Ectostracum.
ep.	Epiostracum.
ex.	Excretory (urinary) white matter.
F.	Fat-cells.
fg.	Food-globules absorbed and lying within the cells of the ventriculus.
G.	Ganglion.
ga.	Genital aperture of ♂.
gp.	Genital plates.
gs.	Genital suckers (so-called).
gso.	Supra-œsophageal ganglion (upper part of brain).
gsu.	Sub-œsophageal ganglion (under part of brain).
gu.	Gland of unknown function.
H.	Hypoderm (endostracum).
L.	Ligament which attaches the sigmoid piece to the chitinous bridge (*B.*).
M.	Muscles seen in transverse section.
ma.	Lower distensor muscles of pharynx.
mb.	Membrane (basal) of genital suckers.
mc.	Constrictor muscles of penial canal.
md.	Mandibles.
mdp.	Membranous projection from dorsal edge of mandible.
mdr.	Retractor muscles of mandibles.
mdt.	Tendon of retractor muscles of mandible.
me.	Dorso-ventral muscles.
mdu.	Terminal claw-like joint of mandibles.
ml.	Maxillary lip.
mlm.	Levator muscles of mandible.
mlp.	Levator muscles of the roof of the pharynx (dilatores pharyngis).
mop.	Occlusor (constrictor) muscles of pharynx.
mu.	Levator muscles of terminal joint (claw) of mandible.
N.	Nuclei.
n 1.	Nerve to 1st leg.
n 2.	Nerve to 2nd leg.
n 3.	Nerve to 3rd leg.
n 4.	Nerve to 4th leg.
na.	The branch of the nerves serving the first and second legs, which is the homologue of the accessory nerve of Croneberg, Schaub, Nalepa, &c.
ng.	Genital nerve.
nm.	Mandibular nerve.
no.	Optic nerve.
np.	Palpal nerve.
np 1.	Palpal branch of same.
np 2.	Branch of same to maxillary lip.
nph.	Pharyngeal nerve.
nr.	Recurrent nerve.
nu.	Nerve of unknown function.
nv.	Nerve to muscles running from the dorso-vertex to the maxillary lip.
ob.	Bulb of the eye.
oc.	Cornea of the eye.
œ.	Œsophagus.
ol.	Lens of the eye.
op.	Pigmental lines (or rods) in the bulb.
P.	Palpus.
pc.	Penial canal.
ph.	Pharynx.
pr.	Roof of pharynx.
ps.	Protecting hair of the outlet of one of the dermal glands.
S.	Stigma.

sa.	Azygous salivary gland.
sb.	Salivary bladder.
sgq.	Quadrate salivary gland.
sgr.	Reniform salivary gland.
sgt.	Tubular salivary gland.
sm.	Sperm-mother-cells.
sp.	Sigmoid chitinous piece containing air-chamber.
T.	Testicular mass.
tr.	Tracheæ.
tra.	Principal tracheal trunk from stigma to air-chamber.
tre.	Efferent tracheal trunk from air-chamber to body.
tv.	True testicular portion of the testicular mass.
tvs.	Portion of testicular mass functioning as a vesicula seminalis.
v.	Ventriculus.
vb.	Hind bridge of ventriculus.
vd.	Vasa deferentia.

All the figures are drawn with the anterior end nearest to the top of the page.

PLATE VII.

External structure.

Fig. 1. ♂. Dorsal surface, × 50, drawn from life.
Fig. 2. ♂. Ventral surface, × 43, drawn from a preparation. The ♀ in both cases would be similar except as regards size.
Fig. 3. Mandible of ♀ from the side, × 175. *a*, membranous portion; *b* tendon of the extensor, *c* of the retractor muscles of the second joint.
Fig. 4. Maxillary lip and right palpus; ¾ view from above and left side, × 85.
Fig. 5. Right palpus from the inner (left) side, × 170.
Fig. 6. Inner edge of the first right epimeron, × 160, to show the hairs &c.
Fig. 7. The lowest except one of these hairs, × 320.
Fig. 8. One of the more finely pectinated hairs, × 320.
Fig. 9. Genital aperture, surrounding sclerites, and so-called suckers of ♂, × 85.
Fig. 10. Anal plate (see remarks pages 185, 186), × 160. *rm.*, retractor muscles of the labia.
Fig. 11. A small portion of one of the chitinous plates in the cuticle seen from within, × 300. It was drawn from one of the lateral plates. *cu.*, soft cuticle.
Fig. 12. Second right leg of ♂ from above, × 95.
Fig. 13. Fourth right leg of ♂ from below and side, × 95.

PLATE VIII.

Internal Organs.

Fig. 14. Ventriculus and excretory organ seen from above, × 65. The excretory organ partly overlies the anterior median cæcum of the ventriculus and then turns downward, passing through the large opening in the middle of the hollow-square-ventriculus.
Fig. 15. The excretory organ alone seen from the side (¾ view), × 85. The inner side of the so-called anal plate is seen, and muscles for distending the anal aperture, which, however, only forms an exit for the excretory organs, not apparently for the alimentary canal.
Fig. 16. The salivary glands and ducts from one side of the body, × 175. The quadrate salivary gland is turned over and separated from the kidney-shaped gland so as to show the ducts; the two glands really lie close together.
Fig. 17. The male genital system seen from above, × 110. The small bulb between the vasa deferentia (*vd.*) and the penial canal (*pc.*) is the ductus ejaculatorius.

Fig. 18. The penial canal, ductus ejaculatorius, and vasa deferentia seen from the side, × 190.

Fig. 19. Section through one of the so-called genital suckers and a portion of the adjoining cuticle, × 580.

Fig. 20. The great central nervous ganglion (the so-called brain), × 175, showing the various nerves proceeding from it, and the œsophagus passing through it. The entire length of one of the optic and one of the palpal nerves is shown, the other nerves are cut short.

Fig. 21. The respiratory organs on one side of the body, × 280, showing the sigmoid piece (*sp.*) with the air-chamber inside, and the connection of the sigmoid piece with the mandible. The tracheal trunk proceeding to the stigma (*tra.*) is shown, as is also a small portion of the efferent tracheal trunk (*tre.*). The distal (anterior) portion of the common duct from the salivary glands is seen behind the muscles, and one band of muscle is partly cut away to show the two ducts from the quadrate gland joining the common duct.

Fig. 22. One of the palpal organs, × 175. The figure does not include quite the whole of the anterior end of the organ, which extends nearly to the distal end of the palpus. The first joint of the palpus and a portion of the second are shown in section.

Plate IX.

Sections.

[All the figures in this Plate are drawn from preparations fixed with picro-sulphuric acid and stained with hæmatoxylin.]

Fig. 23. Sagittal median section of ♂, × 120. It is a thick section so as to show organs which are not quite in the actual median plane if there be not anything in that plane to hide them.

The chitinous plates in the cuticle (*cp.*) are left white, all those in this section are the larger areolated kind of plate, none of the smaller perforated hair-bearing plates come into the median section. Only one dermal gland (*dg.*) is seen at the anterior end; the section just catches the exterior tunic of this gland, so that it is not really a section of the gland but an exterior view; sections of these glands are seen in figs. 24, 25. The azygous salivary gland (*sa.*) and one of the quadrate salivary glands are seen, but neither the reniform nor the tubular salivary glands come into the median section. The œsophagus (*œ.*) is seen passing through the brain (*br.*). The anterior median portion of the ventriculus (*V.*) and its anterior azygous cæcum are seen, as is also the hind bridge (*vb.*) of the organ near the posterior end, but the lateral portions which join the two and complete the hollow square are not seen. The whole length of the excretory organ (*E.*) is shown; it contains excretory matter. The whole length of the pharyngeal nerve (*nph.*) is shown, and just the commencement of the recurrent nerve at the posterior edge of the sub-œsophageal portion of the brain. A small part of the testicular mass (*T.*) on one side of the body is seen in consequence of its having, from its large size, extended itself over the median line. The whole lengths of the penial canal (*P.*) and ductus ejaculatorius (*de.*) are seen, but not the vasa deferentia.

Fig. 24. Longitudinal section through a portion of the dorsal cuticle, × 175. The section cuts through some of the larger (areolated) chitinous plates (*cp.*) and shows that the epiostracum (*ep.*) is gone from above them. The chitin of the plates is left white except in the areolations, which are mostly filled by living protoplasmic tongues from the cells of the hypoderm (*H.*). Two dermal glands are seen in section, but they have not been cut in the plane which contains the duct; this does not fall into the same vertical plane as the areolated chitinous plates.

Fig. 25. Section through one of the anterior dorsal dermal glands, × 175,

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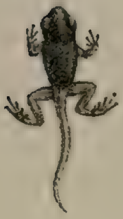
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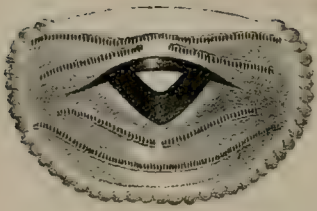
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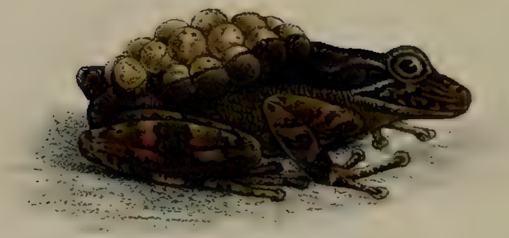
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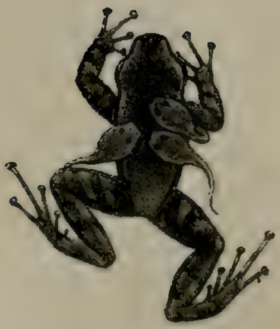
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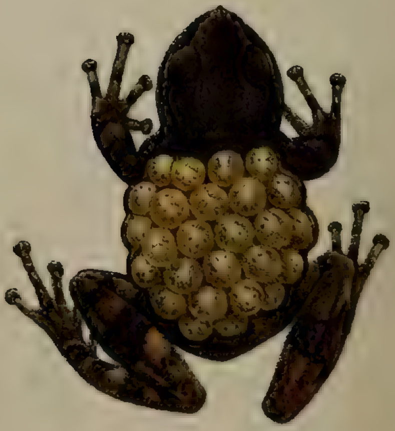
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1-3. HYLA GOELDII 4-5. PHYLLOBATES TRINITATIS.

showing the duct and outlet in one of the small hair-bearing chitinous plates (*cs.*) of the cuticle.

Fig. 26. Dark-staining net-like structure contained in a delicate sac near the duct of some, at least, of the dermal glands, × 600.

Fig. 27. Median sagittal section through the anterior portion of the pharynx, showing the mode in which the distensor muscles (*mlp.*) are attached to the roof (*pr.*) of the pharynx by numerous tendons. The depressor muscles (*mop.*) of the roof of the pharynx are cut across and appear circular in transverse section. The anterior end of the pharyngeal nerve (*nph.*) is seen, with its branches to the respective muscles.

Fig. 28. Sagittal section through the testicular mass on one side of the body of the ♂, × 200. The section is cut in the plane where the vas deferens (*vd.*) emerges. The true testicular portions are composed of sperm-mother-cells (*sm.*), some of which are discharging their contents into the portion (*tvs.*) which functions as a vesicula seminalis. One of the walls of the latero-posterior portion of the ventriculus is seen to the right, containing dark-staining food-droplets within its cells. Between the ventriculus and the testicular mass is seen the gland of unknown function (*gu.*).

3. On the Nursing-habits of two South-American Frogs.

By G. A. Boulenger, F.R.S.

[Received February 28, 1895.]

(Plate X.)

At a recent Meeting of this Society a most interesting communication was read from Dr. E. A. Göldi, in which an account was given of the breeding-habits of *Hyla goeldii*, Blgr., as observed by himself and his cousin Mr. Andreas Göldi in the Serra dos Orgãos, Prov. Rio de Janeiro[1]. I have since received from the latter gentleman two specimens of this rare tree-frog, one of which is a female with the eggs on her back. This specimen I have brought for exhibition before the Society, and I wish to offer a few remarks concerning it, together with a figure.

The frog was captured on the 5th of January of the present year at Colonia Alpina, Santa Rita de Theresopolis, and measures 42 millim. from snout to vent. The whole surface of the back is occupied by one layer of 26 large pale yellow eggs, 4 millim. in diameter, on which the embryos, coiled round the enormous vitelline mass, can be distinguished with the naked eye. The skin of the back is expanded in a feebly reverted fold which borders and supports the egg-mass on the sides, thus suggesting an incipient stage of the dorsal pouch of the allied genus *Nototrema*.

The embryos are much elongate in shape, colourless, with a large flat head, in which the eyes are distinguishable as two black points; no traces of gills are to be seen. One of these eggs is represented, enlarged, on the drawing (Plate X.), together with the young in the condition it leaves the mother.

Since the publication, in 1886, of my synopsis of the various modes by which tailless Batrachians protect their offspring, several new types have come to my knowledge, among which that offered by *Dendrobates*, as observed by Wyman, Kappler, and H. S. Smith, is not the least remarkable[1]. This Batrachian was found to carry its tadpoles on its back, fixed by their buccal suckers, with the object, it is believed, of transporting them from pool to pool. Precisely the same mode of parental care is shown by a frog of the family Ranidæ, *Phyllobates trinitatis*, Garm., a native of Trinidad and Venezuela. A specimen from Venezuela, recently received at the Natural History Museum, is preserved in spirit with the tadpoles sticking to the back in the manner described in the case of *Dendrobates*.

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[1] See above, pp. 94–96.

The sex of the parent which transports the larvæ had not been ascertained in the case of *Dendrobates*. It is therefore of importance to state that in the present instance the feat is performed by the male (as figured on Plate X.), which is distinguished by an internal vocal sac. It was further desirable to ascertain whether any buccal peculiarities existed in the larvæ in connection with their habits, and as the specimens, six in number, are perfectly preserved, this examination offered no difficulty. But, as in the case investigated by Wyman, no peculiarities could be detected: the tadpoles are perfectly normal, of the Ranoid type. There are two series of labial teeth above and three beneath the black horny beak, the lower outer series rudimentary; the inner upper series is widely interrupted mesially, the inner lower very narrowly; the lip is bordered by a series of papillæ which is widely interrupted in the middle anteriorly. The spiraculum is sinistral and the anus dextral. The tail is about twice as long as the body.

EXPLANATION OF PLATE X.

Figs. 1, 1*a*. *Hyla goeldii*, Blgr., female carrying the eggs.
2. An egg from the above specimen, enlarged.
3. Young, on leaving the mother.
4. *Phyllobates trinitatis*, Garm., male carrying the larvæ.
5. Mouth of the larval *Phyllobates trinitatis*, enlarged.

March 19, 1895.

Sir W. H. Flower, K.C.B., LL.D., F.R.S., President, in the Chair.

The following papers were read:—

1. Preliminary Account of new Species of Earthworms belonging to the Hamburg Museum. By Frank E. Beddard, F.R.S.

[Received February 11, 1895.]

The collection of "Terricolæ" made by Dr. Michaelsen in South America is in some ways richer than that of the "Limicolæ"[2].

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[1] *Cf.* Boulenger, Ann. & Mag. N. H. ser. 6, i. 1888, p. 454, & ii. 1888, p. 122.

[2] See Ann. & Mag. N. H. ser. 6, xiii. p. 205: "Preliminary Notice of South-American *Tubificidæ* collected by Dr. Michaelsen, including the Description of a Branchiate Form. By Frank E. Beddard, M.A., F.R.S."

The number of individuals is much greater; but the proportion of new species is not so great. The actual number of new species is, however, much greater. Considering that a good many papers have been written upon the terrestrial Oligochæta of this part of the world by Michaelsen, Rosa, and by myself, I was unprepared for the very large number of new species which Dr. Michaelsen has got together and kindly entrusted to me for description. The collection consisted exclusively of members of the four following families: Lumbricidæ, Perichætidæ, Acanthodrilidæ, and Cryptodrilidæ. The total absence of Eudrilidæ is not of course remarkable, except perhaps as regards the genus *Eudrilus* itself. The entire want of Geoscolicidæ is much more singular. Hitherto, however, the only Geoscolicid which has been found south of the Rio Grande do Sul is the *Titanus forguesi* of Perrier. North of this point the family is apparently one of the most abundant. The Perichætidæ are represented only by a single individual, but this family is not one which is common anywhere in the South-American continent. Their headquarters, as regards the New World, are certain of the West-Indian Islands. Lumbricidæ are fairly abundant in Dr. Michaelsen's collection; but then this cosmopolitan family is abundant everywhere. I am convinced that here as elsewhere the Lumbricidæ have been introduced. Dr. Michaelsen informs me in a letter that he observed the proportion of Lumbricidæ in his gatherings to diminish with the increased distance from the coast; in cultivated gardens near to the seaboard this family was the most abundant. This fact (which Prof. Spencer has confirmed for Australia) is an argument for regarding these worms as the result of intercourse between Europe and the countries in question. A fact which obviously points in the same direction is the invariable identity of the exotic species with European or North-American forms. The characteristic indigenous forms of the temperate regions of South America are of the families Acanthodrilidæ and Cryptodrilidæ. Both of these families occur in Central and North America as well; but they are not by any means relatively so abundant in the south temperate region of the continent. Moreover, the genus *Acanthodrilus* (s. s.) is only found in this part of the world, being represented in the tropical and north temperate parts by *Benhamia*, *Trigaster*, and *Diplocardia*. An examination of this collection, in fact, seems to confirm what previous researches upon the earthworm fauna of America appeared to indicate—namely, that it is possible to divide the Neotropical region into a tropical and a temperate section. The former is characterized by Geoscolicidæ, the latter by the genus *Acanthodrilus*. But in this last genus we have a correspondence between temperate South America and New Zealand. This correspondence is also emphasized by the great prevalence of *Microscolex* in South America and its fairly common occurrence in New Zealand. The Cryptodrilidæ collected by Dr. Michaelsen belong exclusively to this genus; and they are quite as abundant, though perhaps there are not so many species as the Acanthodrilidæ. *Microscolex*, however, is not so restricted to the temperate part of South America as is the genus *Acanthodrilus*. I cannot see any way out of referring Eisen's recently constituted genus *Deltania* to *Microscolex*, a point which I enter into later. It seems, however, judging from the information at hand, that the headquarters of *Microscolex* are the more southerly parts of South America, and that it gradually dies out as we get north, finally disappearing in North America. The very small number of genera coupled with the large number of species is a remarkable feature of the earthworm fauna of the temperate part of South America. Up to the present we are only acquainted with four genera, viz. *Acanthodrilus*, *Kerria*, *Perichæta*, and *Microscolex* (leaving aside the Lumbricidæ as a foreign importation), from this part of the world. Among temperate countries, New Zealand forms a contrast; it possesses certainly six, if not more, distinct genera. I shall now proceed to treat of the different families seriatim.

Fam. ACANTHODRILIDÆ.

This family, as already remarked, is represented in the collection by two genera only—*Acanthodrilus* and *Kerria*. The latter genus is represented by three species, of which I regard two as new. This genus, recently constituted by myself for a small aquatic species from the Pilcomayo and for Rosa's *Acanthodrilus spegazzinii*, has been increased by the addition of two new species from California. It therefore ranges through the South-American and part of the North-American continent. It appears to be rather a tropical form; Buenos Ayres and Valparaiso seem, so far as our present knowledge goes, to mark its southern limit. It is one of those genera that are both aquatic and terrestrial in habit.

Acanthodrilus is represented by a large number of species in South America. Altogether we are acquainted with the following, of which the names of those collected by Dr. Michaelsen are printed in italics:—

1. Acanthodrilus littoralis, *Kinb.*
2. Acanthodrilus hilgeri, *Mich.*
3. *Acanthodrilus pictus*, Mich.
4. *Acanthodrilus dalei*, F. E. B.
5. *Acanthodrilus platyurus*, Mich.
6. Acanthodrilus georgianus, *Mich.*
7. Acanthodrilus falclandicus, *F.E.B.*
8. Acanthodrilus aquarum-dulcium, *F. E. B.*
9. *Acanthodrilus bovei*, Rosa.
10. *Acanthodrilus decipiens*, n. sp.
11. *Acanthodrilus occidentalis*, n. sp.
12. *Acanthodrilus purpureus*, n. sp.
13. *Acanthodrilus magellanicus*, n. sp.
14. *Acanthodrilus bicinctus*, n. sp.
15. *Acanthodrilus minutus*, n. sp.
16. *Acanthodrilus chilensis*, n. sp.
17. *Acanthodrilus cingulatus*, n. sp.
18. *Acanthodrilus putablensis*, n. sp.
19. *Acanthodrilus carneus*, n. sp.
20. *Acanthodrilus corralensis*, n. sp.
21. *Acanthodrilus simulans*, n. sp.
22. *Acanthodrilus albus*, n. sp.

This part of the world must be undoubtedly regarded as the headquarters of this genus. New Zealand comes next in number of species: but there are only seven referable to the genus as strictly defined.

The South-American *Acanthodrili* do not form a definable section of the genus. They all agree, however, in having a clitellum which is rather limited in extent; in only one species does it occupy more than segments xiii.–xvii.; in the New-Zealand species the clitellum often extends back to the xixth segment. The American species, too, are never of large size; a great many of them are very darkly pigmented, a circumstance which is only met with in *Acanthodrilus smithii* among New-Zealand *Acanthodrili*.

It is interesting that many of these species live equally well in fresh water and on land. *Acanthodrilus dalei*, for instance, and *Acanthodrilus pictus* occurred in Dr. Michaelsen's collection from freshwater gatherings as well as from those in forests. This peculiarity of the genus is not, however, confined to the South-American representatives. The New-Zealand *Acanthodrilus paludosus* and the Australian *Acanthodrilus schmardæ* also were collected from freshwater sources. I shall now commence the enumeration of the species collected by Dr. Michaelsen. In the description it will be understood that in all species the nephridia are paired, the dorsal vessel single, the spermathecæ in viii., ix., and, of course, the ovaries in xiii.

(1) **Acanthodrilus decipiens**, n. sp.

To a single specimen of *Acanthodrilus* from near Estancilla, Province of Valdivia, I give the name of "*decipiens*" on account of its strong superficial likeness to a *Microscolex*. I had at first passed it over as an example of that genus, which occurs in the same region. This species is one of the smallest of *Acanthodrilus*; the measurements were: length 35 mm., diameter 2–3 mm. The number of segments of the worm were 110.

The colour (in alcohol) is of a rich brown above, the setæ being implanted within white circles.

The prostomium is continued over the buccal segment by parallel furrows. The setæ are paired, but not so strictly as in *Acanthodrilus dalei*, for instance. The implantation of the setæ is such as to give to the posterior part of the body a quadrangular aspect.

The clitellum occupies segments xiii.–xvii.

Dorsal pores are present.

There appear to be small median genital papillæ upon segments xvii. and xix., with a larger also median papilla upon xx.

As there was only a single specimen of the worm, I am not able to give a complete account of the internal structure, which, however, shows no specially interesting peculiarities.

The gizzard is very large and stout, relatively to the size of the worm.

The spermathecæ have each a single good-sized diverticulum.

The spermiducal glands extend through two or three segments only; the penial setæ, of which I found seven mature and immature in a single bundle, are of a fair length, but are not ornamented.

Hab. St. 41, Estancilla, Valdivia.

A larger specimen from St. 47 measured 46 mm.

(2) **Acanthodrilus occidentalis**, n. sp.

In point of size this is the most conspicuous of all South-American species of *Acanthodrilus*; about a dozen specimens in all were collected by Dr. Michaelsen, and the largest of these slightly exceeds in bulk the largest example of *Acanthodrilus pictus*, which is its only rival in size.

The present species, however, differs from *Acanthodrilus pictus* in being entirely without integumental pigment, a fact which gives to it in the preserved condition a pale dirty brown colour. The worms are very soft to the touch and the segments are very much annulated. The general appearance, indeed, is like that of the New-Zealand species *Octochætus multiporus*; it is very different from that of any South-American species of the genus which I have had the opportunity of examining. The structure, however, does not in any way resemble that of *Octochætus*; *Acanthodrilus occidentalis* is a perfectly typical *Acanthodrilus*, though differing in detail from any other species known.

The largest individual at my disposal measured 192 mm.; its diameter was at the widest point 9 mm. The number of segments of this specimen was 365. The colour of the species after death has been already referred to; during life the colour was (according to Michaelsen) " blau grau; Kopfende zart rosa."

The clitellum during life was hardly visible; I could not detect its limits in the preserved specimens. The obscurity of the clitellum gave the worm a certain resemblance to many Geoscolicids.

The soft feel of the body is due to the minuteness of the strictly paired setæ; the setæ are implanted upon the ventral side of the body; the ventral area within the setæ is to the dorsal area as 7 : 11. On the anterior segments of the body I could not detect the setæ at all.

The prostomium is continued by grooves over the buccal segment.

The dorsal pores commence at the eleventh or twelfth segment.

The internal anatomy shows no characters of very great importance

Some of the anterior septa are thickened; this is the case with the six which immediately follow the gizzard.

The gizzard, in spite of its large size, is entirely contained between the septa which bound the sixth segment. There are no distinct calciferous glands; but the œsophagus is red and vascular posteriorly. The intestine begins in segment xvii.; it has a very rudimentary typhlosole.

The last pair of hearts is in segment xiii.

The reproductive organs are like those of other species of the genus.

There are two pairs of testes in x., xi.; these gonads are very much frayed out and extend right across their segments, looking as if they were attached to both walls.

The sperm-sacs are of fair size; they are racemose in form and are attached to the front walls of segments xi., xii.

The spermiducal glands are small and narrow; they are confined to their respective segments (the xviith and xixth), and lie transversely to the long axis of the body. The penial setæ with which they are provided are slender and unornamented.

The spermathecæ are like those of many species of *Perichæta* in the narrow tubular appendix, which is of the same length as the pouch. The diverticulum ends in a small dilatation.

Hab. St. 7, Valparaiso, Salto; St. 12, Valparaiso, Gärten.

(3) **Acanthodrilus magellanicus**, n. sp.

There were several specimens of this species, of which the one selected for measurement was 66 mm. long and 3·5 mm. in diameter; it consisted of nearly 100 segments.

The colour after preservation was a yellowish grey, owing to the absence of integumental pigment.

The setæ are not strictly paired; the ventral setæ are nearer together than the lateral setæ; but in the posterior part of the body there was less difference in the distance between the setæ.

The clitellum occupies segments xiii.–xvii.

On segment xi. are a pair of large genital papillæ. On the middle of segments xiv. and xv. is a narrow band of glandular appearance; finally, the pores of the spemiducal glands are situated upon large oval papillæ united nearly or completely in the middle line; they also bulge over the intervening segment so as to nearly obliterate it.

Corresponding to the position of the ventral setæ on segments xvii. and xix. are the apertures of the spermiducal glands. When this part of the body is mounted entire in glycerine and examined, the summit of each of the four papillæ already referred to is seen to be perforated by three orifices. One is the actual pore of the gland; the two others each correspond to one of the two penial setæ which accompany the glands; it is not common for the setæ to open thus independently of the glands. The orifices are precisely similar in appearance and are of equal size.

This species has a well-marked gizzard in segment vi. The septa separating segments vi./xii. are stout; the first septum lies between segments v./vi. The last heart is in segment xii.

The funnels of the sperm-ducts lie in segments x., xi.; the racemose sperm-sacs are in xi., xii.

The two pairs of spermathecæ lie as usual in viii., ix.; the pouch itself is oval, and it communicates with the exterior by a long cylindrical duct, which is not very much narrower but is rather longer. Just before the external orifice of the latter are two cæca, which really open by a common pore; they lie one above the other, and not laterally and symmetrically as in *Acanthodrilus bovei*. The two cæca are enveloped in a common sheath, but they are divided by a constriction superficially, which marks a real muscular septum which separates the two diverticula. The lower one is globular in form; the upper, which is larger, is more elongate.

The spermiducal glands are tubular in form and of fair thickness; there is a narrow terminal duct. The glands were bent into an **S**-shape, and did not extend beyond their segment.

The penial setæ are not particularly long. They are regularly curved like a bow. There were four of them in each bundle that I examined—two fully mature and two immature. The end of the seta is abruptly truncated, looking very much as if it had been broken off short. There can, however, be no question of such an accident, as all the setæ presented the same appearance. The free end of the seta, perhaps one-third of its entire length, is ornamented by transverse ridges, which are apparent at the edges as notches.

Hab. St. 99, Magellan Straits, Elizabeth Isl., under cow-dung.

(4) **Acanthodrilus minutus**, n. sp.

Of this species, again, I have only discovered a single specimen in the collection. I have been obliged, therefore, to exercise some care in my dissection of it.

It is of a pale brown colour in alcohol, being apparently without any integumental pigment. On a superficial inspection it might easily be mistaken for a small example of *Acanthodrilus bovei*.

The worm measures 29 mm., its diameter is 3 mm.; the number of segments 70. It is therefore, with the exception of the Australian *Acanthodrilus macleayi* (27 mm.), the smallest *Acanthodrilus* known.

The prostomium is continued by furrows over the buccal segment.

The setæ are strictly paired. In smaller immature specimens, but with more segments, the setæ were seen to diverge from each other posteriorly as in *A. platyurus* &c.

The clitellum occupies segments xiii.–xvii.

The gizzard is large for so small an earthworm, being 2·5 mm. long by 2 mm. broad. The intestine begins in segment xvii.

None of the septa appear to be specially thickened; but those in the neighbourhood of the generative organs are, as is the rule, somewhat more obvious than the others.

The testes and sperm-ducts are, as is often the case with the *Acanthodrilus* of America, single—that is, there are only one pair of each.

The sperm-sacs, racemose and of large size, lie in segment xi.

The spermiducal glands are thick but not very long; they are confined to their own segment. It is noteworthy that the posterior pair are distinctly smaller than the anterior pair, and less coiled. I have observed the same commencing disappearance (?) of one of the two pairs of glands in *Acanthodrilus schmardæ*. The penial setæ are long and recurved at the end in a crozier-like fashion, which is so common in the genital setæ of these earthworms. The extremity is expanded and thin, but not ornamented—two in each bundle.

The spermathecæ have a single rather large tubular to oval diverticulum.

Hab. St. 30, Putabla, Valdivia.

(5) **Acanthodrilus bicinctus**, n. sp.

Of this species there were two examples from Pictou Island and two from Juan Island. The two latter were rather larger than the former and showed a slight difference in the penial setæ, which will be referred to in due course.

The length is 42 mm., diameter 3 mm.; number of segments 80. The larger worm from Juan was 55 mm. in length.

The colour of the species is a dark purple, passing into an orange-brown on the ventral surface. The colour was darker than in most *Acanthodrili*. The prostomium is broad, narrower posteriorly where it is continued over the buccal segment for about two-thirds of its length. Posteriorly the prostomium bears a dorsal groove which is continued to the end of the buccal segment, and is apt to produce the impression of the prostomium entirely dividing the buccal segment.

The clitellum occupies segments xiii.–xvi.: in one specimen it was divided by a median furrow into two halves, each consisting of two segments; this circumstance suggested the specific name.

There are median unpaired genital papillæ, extending between the ventral setæ on segments xx. and xxi. in one individual, and in another on to the two following segments also.

The gizzard is well developed.

The reproductive organs are not very different from those of some allied species; I fancy that the gonads are only one pair of testes, and of course one pair of ovaries, but am not quite certain. In any case there is but a single pair of large racemose sperm-sacs in segment xi., as is so general.

The spermiducal glands are large and flattened, being coiled several times in one plane; the two following glands of each side of the body form an almost continuous mass occupying segments xvi.–xx. The narrow muscular duct of the gland arises from about the middle of the coil. It is accompanied by a sac containing two penial setæ which are fully mature, and two immature ones. The former are of a particularly bright yellow colour. One is bent like a bow in a regular curve and ends in a sharp point; its distal third is beset with sharp downwardly directed spinelets. The other seta is of quite a different form. To begin with, it is at least quite half as long again as the first and is more flexible; this appears to be shown by the whip-like curvature of the distal extremity, which is disposed almost in coils. It terminates in an obtusely pointed extremity. Less than the distal third of this seta is beset with excessively fine spinelets, much finer than in the other seta. There can be no question that both setæ are fully mature and they show a dimorphism. A similar dimorphism has been indicated by myself to exist in *Acanthodrilus georgianus*. It has also been met with elsewhere. In the specimen from Juan

Island which I examined the dimorphism was not apparent. The mature setæ were of the longer type with a flexible extremity; the end was slightly dilated and beset with very fine spinelets. If I had had more specimens at my disposal it is possible that it might have been found necessary to divide these examples from Juan Island into a distinct variety.

The spermathecæ (as usual in viii., ix.) are oval sacs with a moderately short duct; with the latter communicates the diverticulum, which is longer than the pouch and has a crenate outline above.

Hab. St. 174, Pictou Island; 58, Smyth Channel, Wide Bay, Juan Island.

(6) **Acanthodrilus purpureus**, n. sp.

Of this species there was only a single specimen in the collection. It was somewhat softened and therefore the measurements are perhaps a little higher than one would be inclined to allow as typical.

The length is 95 mm., the diameter 5 mm.; the number of segments 98.

The colour (in alcohol) is a reddish purple above, passing into an orange-brown below; the clitellum is distinctly without pigment, being yellowish brown.

The prostomium does not extend at all over the buccal segment.

The setæ are strictly paired.

The clitellum occupies segments xiii.–xvi. and is quite complete.

There seem to be no papillæ of any kind.

The gizzard lies in segment vii. The last heart is in xii.

The spermathecæ have each a longish tubular diverticulum dilated at end.

The spermiducal glands are loosely and irregularly coiled, extending through several segments; the penial setæ with which they are provided are curve-like and of moderate length only. The extremity is pointed and the distal end of the seta is furnished with numerous spinelets, which have a broad base of attachment and the points of which are directed forwards.

Hab. St. 81, Magellan Straits, Punta Arenas.

This species comes perhaps nearest to *Acanthodrilus bicinctus*. It indeed only differs by its much greater size, by the shorter penial setæ, and by the form of the prostomium.

(7) **Acanthodrilus chilensis**, n. sp.

This species, again, is unfortunately represented by a single specimen only, which had therefore to be discreetly dealt with.

It is 80 mm. long by 5 mm. in breadth; the number of segments 150.

The colour (in alcohol) is a dark purplish above, passing into an orange colour below.

The prostomium is completely joined to the second segment by furrows.

The setæ are strictly paired anteriorly; posteriorly they diverge slightly from each other, as is the case with *Acanthodrilus platyurus*; but the divergence is by no means so marked as in that species.

The clitellum occupies segments xiii.–xvi.

The dorsal pores are quite obvious, commencing at any rate on xii./xiii.

The gizzard occupies two segments, vi. and vii., the septum being present.

The septa dividing segments viii./xii. are thickened, but not much.

The last heart is in segment xii.

The sperm-sacs, as in so very many species, are in xi., and racemose.

The spermathecæ are longish and of a reddish colour; the diverticulum is considerably shorter than the pouch.

The spermiducal glands are not very long or much coiled; they are also reddish in colour. The penial setæ are brown, a colour which is, according to my experience, rare in *Acanthodrilus*. Their form hardly differs from that of *Acanthodrilus platyurus*.

Hab. St. 39, Teja Island, Valdivia.

This species is clearly a close ally of *Acanthodrilus platyurus*. The most ready way of distinguishing them is by the form of the spermathecæ. If it were not for the different position of the last heart I should have been inclined to regard the present species as merely a variety of *Acanthodrilus platyurus*. Three specimens from St. 48, Corral, appear to belong to the same species, but they are very much paler in colour. The spermathecæ have the same red colour and its diverticulum is similar. Possibly a larger series of specimens would allow of the separation of the two forms.

(8) **Acanthodrilus cingulatus**, n. sp.

Of this species five or six individuals were collected by Dr. Michaelsen.

The largest of them—the only one that was fully mature—measured 58 mm. in length by 4 mm. in diameter; the number of segments 106.

The worm is darkly pigmented, but the colour is more brown than purple.

The setæ are strictly paired and do not show any signs of divergence from each other at the tail end of the body.

The prostomium is continued by furrows over the buccal segment.

The clitellum is unusually far back for the American members of this genus; it extends from segment xiv.–xviii. inclusive.

Dorsal pores are obvious.

There is a large gizzard in segments vi., vii.

The spermathecæ are oval pouches with a smallish diverticulum not one-half of the length of the pouch.

The testes and the funnels are in segment x.

The spermiducal glands are coiled a good deal; the first pair are distinctly larger than the second pair; as this was found to be the case in two specimens not selected in any way, it may, I imagine, be safely regarded as normal for the genus. I have pointed out in the present paper that *Acanthodrilus minutus* shows the same peculiarity, also seen in the Australian *Acanthodrilus schmardæ.* The penial setæ are expanded and recurved at the extremity, and are very similar to those of *Acanthodrilus platyurus.*

Hab. St. 39, Island of Teja, Valdivia.

(9) **Acanthodrilus putablensis**, n. sp.

Of this species there were two examples, one of which was larger than the other. I had at first passed by the worms on the assumption that they were examples of *Acanthodrilus platyurus.* The coloration, however (of the preserved worms), is a little different from that of any of the examples of *A. platyurus* in the collection; and a nearer inspection showed other external differences which rendered their separation from *A. platyurus* even more obvious. The main external difference is in the arrangement of the setæ; but in order to appreciate it properly, for it is, after all, slight, it is requisite to compare individuals of both species somewhat closely; it can then be made out that, while there is the same divergence of the setæ of each pair from each other posteriorly, the distance which ultimately separates the setæ of each pair is distinctly greater in the species now under consideration than in the allied *A. platyurus.*

The worms were of stout build, and evidently rather contracted by the preservative reagent. The length is 82 mm. by 8 mm.; number of segments 150.

The skin of one individual was invaded by numerous encysted Gregarines. These formed a series of white warts upon the skin, a situation where I have never before observed Gregarines; the interior of the body was also full of the parasites.

The prostomium is quite completely developed, dividing the buccal segment.

The clitellum occupies segments xiv.–xvi.

The gizzard is stout and lies in segment vi.; after the gizzard are two thin septa; those separating segments viii./xiv. are strengthened. The last hearts are in segment xiii. It is the reproductive organs which show the greatest differences from *A. platyurus.* The testes, however, are, as in that species, one pair in x.; the funnels in the same segment are highly vascular, as are also the oviducts, which occupy the usual position. The sperm-sacs are not like those of *A. platyurus*, in that one pair exist in the xiiith segment; there is another pair in ix. Although the sperm-sacs are in xiii., I presume that the ovaries are there also, for the oviducal funnel undoubtedly projects into that segment.

The spermiducal glands are much like those of *A. platyurus.* They are somewhat slender and confined to their segments; the posterior pair was decidedly smaller than the anterior. The penial setæ are a facsimile of those of *A. platyurus.*

The spermathecæ have two symmetrically arranged short diverticula.

Hab. St. 30, Putabla, Valdivia.

(10) **Acanthodrilus carneus**, n. sp.

A number of specimens of this species were collected at Quilipue. They show when in alcohol a reddish-violet colour, which, however, is due to their tissues having taken up the colouring-matter from a Myriopod placed in the same bottle. The real colour of the worm during life is, according to Michaelsen, "schmutzig fleischfarbe; Gürtel weiss."

The length of one of the largest specimens was 52 mm. by 3·5 mm. in diameter. The number of segments of this specimen was about 100.

The prostomium is large and completely divides the buccal segment.

The setæ are paired, but not very strictly; the ventral setæ of each pair are rather closer together than are the lateral setæ.

The clitellum occupies segments xiii.–xvi. and is complete all round.

As is so often the case, this species is provided with a certain number of genital seta papillæ; as is also frequently the case with the worms of this genus, these papillæ are subject to some variation.

In one specimen there was a single eye-like papilla on the boundary line of segments x./xi. In another there were two median papillæ, one upon x. and the other upon xi.; in two others, and this appears to be the more typical arrangement, there were the two papillæ already mentioned and in addition to them paired papillæ upon ix.

The dorsal pores are quite conspicuous and begin in front of the clitellum.

The internal characters are not very different from those of other species.

The gizzard is well developed and lies apparently in segment vi.

The last heart is in the xiith segment.

There appears to be only one pair of testes and of funnels in segment x.

The sperm-sacs are in segments ix., xi.; those of the latter segment are very coarsely racemose. The penial setæ are unusually delicate and slender; they taper towards the free end, which is not ornamented; perhaps on account of their slenderness they are not of the yellow colour so usual.

The spermathecæ in viii., ix. are oval pouches with a wavy tubular diverticulum nearly as long.

Hab. St. 3, Quilipue.

(11) **Acanthodrilus corralensis**, n. sp.

Of this species there was only a single individual.

It is tolerably large, measuring 103 mm. in length by 5 mm. in diameter; number of segments 145.

The colour is very much that of *Acanthodrilus pictus*; and it also resembles that species in the fact that the prostomium only extends over about one half of the buccal segment.

On the other hand, *Acanthodrilus corralensis* differs from *A. pictus* in that the setæ are strictly paired from end to end of the body, being only to a very slight extent separated at the posterior end of the body. In this region the body has a roughly quadrangular section, the setæ being implanted at the angles. The symmetry of the figure, however, is broken, owing to the two ventral pairs being closer together than the two dorsal.

The clitellum occupies segments xiii.–xvii. and is complete.

The dorsal pores commence at any rate in the clitellar region.

None of the intersegmental septa are especially thick. Those separating segments x./xiii. are rather stouter than the others.

The gizzard lies anteriorly to the first pair of spermathecæ, but I am not able to fix its segment with precision. In the xivth and xvth segments, particularly in the latter, the œsophagus is enlarged and highly vascular, its lining membrane being folded.

The last pair of hearts are in segment xii.

The testes and sperm-duct funnels are one pair only in segment x. The racemose sperm-sacs are in ix. and xi.

The spermiducal glands are like those of a few other species of the genus in that the anterior pair are distinctly larger than the posterior.

The penial setæ, of which there were two in the bundle that I examined (the posterior on the left side), are crooked at the end like a crosier. The ends of the setæ have numerous denticulate ridges. The setæ resemble, in fact, very closely the penial setæ of *A. pictus*.

The spermathecæ are not very large; each is an oval sac, to the duct of which is fixed the very slender duct of the appendix, widening out above into an oval sac. The diverticulum of the spermatheca is about half the size of the pouch.

Hab. St. 47, Corral, "Wald, unter Steinen."

(12) **Acanthodrilus simulans**, n. sp.

This species was found in a large gathering of worms from Corral in company with the last species and with a considerable number of examples of *Microscolex spatulifer*. The external characters of *A. simulans* are so like those of the last-named species that they were at first passed over accidentally. It is the colour which is so strikingly like. In the specimens of *M. spatulifer* from this locality the colour of the dorsal surface was a reddish brown instead of the more usual violet. Precisely the same colour was found in the *Acanthodrilus*. As this species is also characterized by a complete prostomium and strictly paired setæ the likeness is increased. The length of the largest specimen is 82 mm., diameter 4 mm.; number of segments 150.

The clitellum was not developed. There are dorsal pores.

The gizzard is well developed and lies in vi., vii.; the œsophagus in segments xiv. and xv. is extremely vascular, being a bright red colour, which entirely disappears in the narrow section of œsophagus lying in xvi. The intestine begins in xvii. The last heart is in segment xii.

None of the septa are greatly thickened, nor are any of them extended backwards in the cup-like fashion so prevalent among earthworms. Septa ix./xii. are somewhat stouter. There appears to be only a single pair of testes and sperm-duct funnels in x. The sperm-sacs in ix. and xi are very large and coarsely racemose.

The spermiducal glands show the same inequality of size between the anterior and posterior pairs that has been noted in other species. They are both stout, but short and only slightly coiled. The penial setæ are not particularly long; they are spatulated at the free extremity, and, when seen in profile, doubly curved in the usual way. They are not, however, ornamented.

The spermathecæ occupy the usual segments. The single diverticulum is nearly as large as the pouch. It is chalky white (owing to the presence of spermatozoa) and has a crenate outline.

The posterior pair of spermathecæ are larger than the anterior pair, which is doubtless correlated with the difference in size of the spermiducal glands.

Hab. St. 47, Corral, "Wald, unter Steinen."

(13) **Acanthodrilus albus**, n. sp.

This species again is represented by a single specimen, which I at first passed over under the impression that it was *A. bovei*. It has the same long and slender form and absence of integumental pigment. *A. bovei*, however, has not been met with so far north on the eastern side of the continent as the present species. which may perhaps be looked upon as its representative there. Length 85 mm., diameter 2 mm.; number of segments 145.

The prostomium seems to be not continued across the buccal lobe, but I am not certain as to this point.

The setæ are paired; the ventral more strictly than the lateral.

The clitellum occupies segments xiii.–xvii.; there are dorsal pores.

The gizzard is well developed, contrary to what we find in *A. bovei*; it occupies the vith segment.

The intestine commences as usual in segment xvii. None of the septa are very much thickened; those of ix./xiii. are most so.

The segments occupied by the sperm-sacs are somewhat unusual. The sacs, which are racemose in character, occupy segments ix., xi., xii. As there were no sacs in segment x., I am inclined to believe that the testes and funnels lie there, but have not seen them. The spermiducal glands are slender and moderately coiled. The penial setæ are long for the size of the worm and also slender. They are curved in the usual way and terminate in a very pointed extremity. The setæ are not ornamented. The spermathecæ are tubular in shape and have a tubular diverticulum of equal length.

Hab. St. 47, Corral, " Wald, unter Steinen."

Genus **Kerria**, Beddard.

The collection contained examples of at least three species of this genus, of which I regard two as new. The species which is not new is Rosa's *Acanthodrilus spegazzinii.* I have before expressed the opinion that this species is really a member of the genus *Kerria.* I am now in a position to confirm that supposition. The genus is at present chiefly known from an excellent paper by Eisen upon new species which he discovered in California.

The existence of this paper renders it necessary for me to enter into the minute anatomy of the species, to which I refer, or which I describe, for the first time in the present paper. The genus is, so far as we know at the present time, exclusively American. It also appears to be a tropical genus, or at least to be a native of the warmer parts of the American continent. The original species of the genus, Rosa's "*Acanthodrilus*" *spegazzinii*, was met with in the neighbourhood of Buenos Ayres; my species *Kerria halophila* was brought back by Mr. Graham Kerr from the upper reaches of the Pilcomayo River. The new species which I describe in the present paper were found at Buenos Ayres and in Valdivia. Eisen's species were found by him in Lower California. The two northern species of the genus differ from the southern species in having no gizzard and in having diverticula of the spermathecæ.

(1) **Kerria rosæ**, n. sp.

Eisen has used as a character for distinguishing the different species of this genus the number of setæ present upon the segments which bear the pores of the sperm-ducts and of the spermiducal glands. This character is probably valuable, but it must be used with circumspection. In two examples of the present species the setæ upon the segments in question differed. In one individual they were all present; in another the inner of the two ventral setæ was alone present on segments xvii.-xix., excepting on one side of one segment, where the outer seta alone was present. There is no doubt that this difference has some relation to the condition of the maturity of the worm, but the same remark may possibly apply to other cases.

The species to which these observations apply is a longish, thin worm, rather more than an inch in length and about 1 mm. in breadth. A large number of specimens were collected under stones on the banks of the river Baraccas do Sul near Buenos Ayres. The species is described by Michaelsen as having been "flesh-red" during life; none had a clitellum.

The alimentary canal has, as in *Kerria halophila*, a gizzard, but it is rather more slightly developed. The muscular walls are only about twice the thickness of the epithelial lining; the chitinous cuticle secreted by the latter is not at all thick. As in all the other species of *Kerria*, there are a pair of calciferous glands in the ninth segment. The structure of these is, however, a little more complicated than in *Kerria zonalis* or *Kerria macdonaldi*, in which species it has been figured by Eisen.

The walls of the pouch are of considerable thickness and project here and there as folds into its lumen. In the thickness of the walls run numerous blood-vessels; but the tissue of which it is composed is permeated by channels which are intra-cellular. The tissue in fact looks like a closely welded mass of nephridial tubules. The minute structure recalls that of the dorsal diverticulum of the alimentary canal in *Bucholtzia*, and it is—so to speak—an exaggeration of the structure which I have described in the distal part of the calciferous gland of *Gorduodrilus*. The œsophagus is narrow and nowhere sacculated; its ciliation commences at the orifice of the calciferous glands. The large intestine begins in segment xii. Septal glands are present as in other species. I did not find them further back than segment vii.

The anterior septa are thicker than those which follow. The stoutest are those between segments vi./ix.; but the three which come next are also moderately stout. The last heart is in segment xi.

The spermathecæ lie in segments viii. and ix.; they are sessile upon the body-wall, with no long stalk, nor have they any trace of a diverticulum. The extreme end of each pouch is enveloped in a thick muscular layer derived from the body-wall; this is continuous over the pouch for but a short way from the pore. The muscular sheath is so perfectly continuous with the two muscular layers of the body-wall that it is really impossible to say where the body-wall ends and where the sheath of the spermatheca begins. The lining epithelium of the spermatheca is folded and forms numerous narrow ridges.

The testes, sperm-sacs, ovaries, and oviducts are of the form, and occupy the positions characteristic, of the genus. The spermiducal glands are long and coiled; the muscular part of the organ is also of considerable length.

Hab. St. 204, Buenos Ayres, Baraccas do Sul, "Unter Steinen, Ufer des Flusses."

(2) **Kerria saltensis**, n. sp.

The general aspect of this apparently new species recalls that of the species *Kerria halophila*. But it evidently differs from that species, though not in very important points; indeed, all the American species of the genus come near together. I leave out in the following description the majority of the characters which are, so far as our present knowledge goes, of generic value and confine myself to those characters which appear more or less to distinguish the species. It is a small species, about an inch in length; there is no pigmentation at all discernible. The clitellum occupies segments xiv.–xx., and is incomplete ventrally on the genital segments, *i. e.* segments xvii.–xix. On those segments only the inner of the two ventral setæ are present.

There is a not very well developed gizzard in segment vii. The calciferous glands, as usual, are in ix. They are rather thick-walled, but are without any folds of the lining epithelium. The walls are vascular, but whether there is the mass of tubules which I have described in the last species I am unable to say. The intestine appears to begin in segment xiii. At any rate in this segment the lining epithelium undergoes a sudden change in thickness, being from that segment onwards much thinner; at the end of the twelfth segment the thick epithelium projects into the lumen of the gut of the next segment and forms a kind of trap which would allow of the passage of food backwards, but would not allow of its passage in the opposite direction. The first segment of the intestine, however, as I find it, is of less calibre than the section which commences in the fourteenth segment; but it differs from the section which begins in that segment by being rather folded.

The thick septa occupy segments v./ix., but the next two are thicker than those which follow. The last heart is in xi.

The spermathecæ, without any diverticula, are in viii., ix.; they consist of a thick-walled duct and of a thin-walled portion which is stored with sperm. The length of the two regions of the spermathecæ is about the same.

The epithelium which lines the thick-walled section of the organ which may be regarded as the duct is thrown into folds; there is no folding of the distal section. The testes are, as usual, in segment x. This segment also contains the sperm-duct's funnels. There seems to be only a single pair of sperm-sacs, which are in segment xi., and are not racemose in character. The cavity of the tenth segment contained a mass of developing sperm; but this cannot be regarded as the equivalent of a sperm-sac, for it was not surrounded by any membrane. The sperm-ducts were not developed in the specimen which I examined by means of transverse sections; on the other hand, the oviducts were fully developed, and their openings on to the exterior in segment xiv. were quite obvious. The spermiducal glands reached back as far as the twenty-fifth segment.

Hab. Valparaiso, Salto.

Fam. CRYPTODRILIDÆ.

The family Cryptodrilidæ is represented in the present collection by the genus *Microscolex* only. Nor has any other genus belonging to this family been recorded from the southern parts of the American continent. Michaelsen's *Cryptodrilus spatulifer* is the only Cryptodrilid that we at present know from the temperate regions of South America. Michaelsen does not pretend to definitely assign this species to the genus *Cryptodrilus*; he only placed it there (with a query) pending the revision of the Cryptodrilidæ. The classification of that family is one of the most difficult tasks for the systematist; the differences are so slight between species and species that the boundaries of genera are extremely hard to draw. I believe, however, that it is possible to define the genus *Microscolex* by the following characters:—

(1) Nephridia paired, beginning in the second to fourth segment.
(2) Male pores upon segment xvii.
(3) Sphermiducal glands tubular, provided generally with penial setæ.

This definition is naturally somewhat wider than that adopted by Rosa, the founder of the genus. But a number of new forms which I shall describe immediately necessitate an expansion of the genus. They do not present a sufficient number of salient differences to warrant the formation of a new genus. I have already proposed to include my genus *Rhododrilus* in *Microscolex*, and I do not see sufficient reasons for retaining the genus *Deltania* of Eisen. *Cryptodrilus spatulifer* of Michaelsen must, I think, especially in view of the new species to be described here, be relegated to *Microscolex*. The size is really the only bar to its inclusion. I find a good many individuals of *Microscolex dubius* which are really quite as large as many individuals of *Microscolex spatulifer*. The distribution of this genus is interesting. It is the commonest earthworm in point of number, and nearly so in point of species, in the temperate parts of South America. I quite agree with Rosa that it has probably been introduced into Italy and possibly also into Australia; I described a species from Teneriffe and one from Algeria which are very likely to be regarded in the same way.

The remaining species occur in New Zealand (*Microscolex minutus and M. novæ-zealandiæ*) and in California (the genus *Deltania* of Eisen).

Dr. Michaelsen's collection contained examples of the following species:—

1. *Microscolex spatulifer* (Mich.).
2. *Microscolex dubius* (Fletcher).
3. *Microscolex griseus*, n. sp.
4. *Microscolex michaelseni*, n. sp.
5. *Microscolex corralensis*, n. sp.
6. *Microscolex diversicolor*, n. sp.
7. *Microscolex longiseta*, n. sp.
8. *Microscolex robustus*, n. sp.
9. *Microscolex modestus*, Rosa.
10. *Microscolex gracilis*, n. sp.
11. *Microscolex papillosus*, n. sp.

It will be seen, therefore, that this collection contains a large number of new species; evidently South America is the headquarters of this genus as it is of *Acanthodrilus*.

Eisen allows three genera of worms where I only allow the genus *Microscolex*. These genera are of course my *Rhododrilus* and Eisen's *Deltania* in addition to *Microscolex*. *Deltania* is distinguished from both by the closer approximation of each pair of ventral setæ in the segments near to the xviith. *Rhododrilus* is distinguished from both by the separate opening of sperm-ducts and spermiducal glands. This latter character will hardly suffice as a mark of distinction; there are so many intermediate conditions in the genus *Microscolex* (s. s.). In *M. gracilis* the two unite well within the body-cavity; in *M. novæ-zealandiæ* just at the common orifice; in *M. papillosus* the external orifices are separate but still close together, in *M. michaelseni* at some little distance apart; finally in *M. modestus*, as I have an opportunity for stating here, the pore of the sperm-duct is positively in the next segment to that which contains the orifice of the spermiducal gland. Nor do I admit that the approximation of the ventral setæ in the genital segments is a character of sufficient importance to imply generic distinction. To begin with, *M. diversicolor* is somewhat intermediate, the approximation being less marked. Then the species of the genus are not all of them furnished with distant setæ; in a good many of the South-American species the setæ are strictly paired; this difference is itself of greater importance, I think; and the close pairing of the ventral setæ in the neighbourhood of the male pores is an intermediate condition between the paired setæ and the distant setæ. If it is thought necessary to divide what I here call *Microscolex* into two genera, a more suitable line of division, as it appears to me, would be to separate off those species in which the testes and sperm-duct funnels are only one pair; this division would include all the new species described in the present paper with the addition of *Microscolex spatulifer*, and would include all the South-American forms, excepting only *M. dubius* and *M. modestus*. I do not, however, propose even this division of the genus.

Most of the new species differ from *Microscolex modestus* and *M. dubius*, the types of the genus, in having a prostomium which entirely divides the buccal segment, and in that the setæ are strictly paired. As, however, these two characters are not always correlated, I do not think it possible to create any new genera. Another interesting feature about some of the new species of *Microscolex* is that, like *M. spatulifer* and many of the *Acanthodrilus*, they are very brightly coloured.

The internal structure does not present much of great interest. Indeed, the uniformity of the Cryptodrilidæ as a whole is in striking contrast to the greatly varied structure of the Eudrilidæ, with which I do not think that anybody now would venture to associate them.

(1) **Microscolex griseus**, n. sp.

This species, like *Microscolex spatulifer*, is one to which the generic name *Microscolex* is etymologically inapplicable. It is a large species, nearly if not quite as large as *Microscolex spatulifer*.

A considerable number of specimens were collected in a garden in Valparaiso. They vary greatly in size, some being mature and others not so.

The biggest specimen is 84 mm. in length by 5 mm. in diameter. The number of segments of this individual was 117.

The colour of the living worm is described by Michaelsen in the following terms: "schmutzig grau; vorne schmutzig fleischfarbe; Gürtel weiss bis bräunlich." The preserved worms are of much the same colour.

During life the worm was remarkable as "lebhaft schlängelnd bei Berührung."

The setæ are strictly paired. Dorsal pores are present.

The clitellum occupies segments xiii.–xvii. There is a median genital papilla upon segment xvi.; the male pores are on xvii.

The prostomium, as in so many species of the genus, is completely carried over the buccal segment by grooves. The first setigerous segment has in most specimens a furrow on the dorsal surface which extends right across that surface, but is not visible ventrally. This gives a little the impression that the prostomium is an incomplete one.

The gizzard is large; it lies in segment vi. It is immediately followed by a thin and delicate septum, behind which are five septa, moderately thick. The last heart is in the twelfth segment.

The sperm-sacs are in the ixth and xith segments; those of the latter segment are so coarsely racemose that they appear to be formed of a number of small separate sperm-sacs; this does not apply to the anterior pair.

The spermiducal glands are different from those of any other *Microscolex* which I examined in their regular tubular form and in the complex coiling; they look much more like the corresponding glands of certain Acanthodrilidæ. Moreover, the duct of the gland is unusually conspicuous; it is also long and is not more than one-third of the diameter of the gland. It has a distinctly nacreous glitter. In common with the spermiducal glands opens on each side of the body a sac of penial setæ; there are two of these on each side. They are very yellow in colour and have a bent bow-like form. The extremity is only moderately pointed and a little flattened and expanded. Fine spinelets ornament the extremity.

The spermathecæ in segment ix. are particularly large. The racemose diverticulum is borne at the end of a long muscular stalk.

Hab. St. 12, Valparaiso, in garden; St. 6, Quilipue; St. 22, Coronil; and St. 25, Valdivia, San José.[1]

(2) **Microscolex longiseta**, n. sp.

This is a small, rather transparent species, with little or no trace of integumental pigment.

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[1] From each of the last two stations a single individual *probably* of this species.

The length of a specimen selected for measurement was 40 mm. by 3 mm. in diameter.

Number of segments 95.

The prostomium is complete. Dorsal pores are visible.

The clitellum occupies segments xiii.–xvii., and is not developed all round the body.

There are no papillæ of any kind that I could discover.

The gizzard is in segment vi. The last heart is in xii. The sperm-sacs in xi.

The sacs of penial setæ are, as in *Microscolex papillosus,* of enormous length. They measure 6 mm. and extend through fourteen segments. The spermiducal glands, on the other hand, only extend through six segments. The penial setæ have the same form as in *Microscolex papillosus.*

The spermathecæ are also exactly as in that species.

Hab. St. 193, Tierra del Fuego, Puerto Pantalon; St. 187, Tierra del Fuego; St. 140, Uschuia; St. 178, Navarin, Porto Toro.

(3) **Microscolex papillosus**, n. sp.

Of this rather remarkable new form three individuals were taken in forest at Uschuia.

The largest specimen measures 87 mm.; its diameter is only 3 mm.; the number of segments 95. The worm is thus a slender species.

Like so many of the American species of *Microscolex*, it is pigmented; but the pigmentation is not very great, the anterior end of the worm dorsally being alone much coloured. The colour is purplish. In one individual there was no pigment.

The setæ are quite strictly paired. The prostomium is not continued by furrows over the entire buccal segment; it extends over about half of it. The clitellum occupies segments xiii.–xvi.; it is complete. On the sixteenth segment in the middle line is a deep hole, looking as if caused by the contraction of the stout muscles connected with it and passing to the dorsal parietes.

This is very characteristic of the species, and was not confined to the largest individual which was selected for dissection. It lies in the clitellar region, but is lined by a strong tall epithelium, which is not glandular like that of the clitellum.

There seem to be no dorsal pores.

The genital papillæ are very numerous, an unusual state of affairs in this genus. There are at least six of them round somewhat translucent areas, possibly rather sense-organs than glandular papillæ, upon the middle of segments xii.–xii.; I am inclined to think that others were to be distinguished upon the clitellum. But I did not, with a view of preserving the specimen intact, submit this part of the body to a microscopical examination. In another specimen there was an additional papilla upon xiii., a smaller median papilla upon xv., and a pair upon xvi., one on either side of the median depression.

The male pores upon segment xvii. are very prominent; each is situated on a conspicuous papilla; the end of the spermiducal gland appeared to be protruded, thus forming a second "papilla" of smaller size upon the first.

The two orifices are near together.

The internal characters of this *Microscolex* serve in great part to differentiate it from its allies, among which *Microscolex longiseta* is the nearest. The first septum divides segments iv.–v.; septa ix.–xii. are thickened. There is a moderately sized gizzard in segment v. The intestine seems to begin in xvii., but in longitudinal sections I cannot draw a line between it and the œsophagus. The latter is straight until the end of xi.; afterwards it is constricted by the septa. The sperm-sacs are in segment xi., as is so generally the case with the worms of this genus. The testes and funnels are in x. There is also a pair of sperm-sacs in ix., attached to the posterior wall of that segment and racemose, though containing little or no sperm.

The single pair of spermathecæ are in segment ix. Each is an oval pouch with a diverticulum as long as itself; the diverticulum is coiled in a spiral and ends in a swollen extremity. This is lined with a much-folded epithelium, so that the lumen appears to be divided by numerous radiating partitions.

The most remarkable feature in the internal organization of the worm concerns the spermiducal glands. These are very long and of the usual tubular form. The entire efferent apparatus extends back to the xxviith segment, thus occupying ten segments. It measured 8 mm. in length. The spermiducal gland, however, did not reach so far back; but the muscular sac containing the penial setæ passed beyond the end of the spermiducal gland. The latter is coiled slightly upon itself once or twice; it opens on to the exterior by a moderately short and narrow muscular duct. The sac containing the penial setæ contained two of them, which were of such different lengths that one might speak of a dimorphism in the setæ. One measured the full 8 mm., the other was not half its length. They were alike, however, in their form being without ornamentation at the free end. The sac contained an immature seta of a pale colour contrasting with the bright yellow of the mature seta, which was much longer than the smaller of the mature setæ. The base of implantation of these penial setæ was supplied with abundant blood-capillaries. The penial setæ, the single sperm-duct, and the spermiducal gland open separately on to the exterior, though near together.

(4) **Microscolex michaelseni**, n. sp.

This is one of the most abundant species of Earthworms among the worms collected by Dr. Michaelsen. I have great pleasure in associating it with his name as a mark of my respect for the valuable work which he has done in this department of natural history.

The present species is a very well-marked form, and it is a matter of surprise to me that it has never yet been described from this part of the world. It appears to be a very southern Patagonian form. It occurs in fresh water as well as upon dry land, as is also the case with *Acanthodrilus pictus* and a few other worms.

The species is long and slender, and is quite bleached by the alcohol.

A typically sized specimen selected for measurement was 85 mm. long by 3 mm. broad, and consisted of 92 segments.

The prostomium is continued for some way over the buccal segment by grooves, but these do not reach the end of that segment.

The setæ are more paired ventrally than laterally, the distance between any two lateral setæ being about twice that between the ventral setæ. The clitellum occupies segments xiii.–xvi. and is quite complete.

The nephridiopores open in front of seta 3.

The oviducal pores lie exactly in line with seta 1.

The most characteristic external feature in the organization of this worm is afforded by the male pores. These pores in the present genus are, as a rule, very conspicuous, but are more or less rounded orifices confined to the xviith segment. In *Microscolex michaelseni* the male apertures are represented by crescentic slits, which commence upon about the middle of the xviith segment and extend back to at least the posterior extremity of that segment, and sometimes even encroach upon the xviiith segment. This groove is wider in front than behind. An investigation of it by means of transverse sections showed that the spermiducal glands and the penial setæ opened in common at the anterior end of the groove where it is widest. The sperm-ducts open at the posterior end. In this wide separation between the external apertures of the sperm-ducts and the spermiducal glands, the present species resembles *Microscolex* (*Rhododrilus*) *minutus*. It will be observed also that the present species is almost an Acanthodrilid in the relations between these organs. The only actual difference between the Acanthodrilidæ and the Cryptodrilidæ which is invariable, is that in the one (Acanthodrilidæ) the sperm-ducts open a segment behind or in front of the spermiducal glands; in the Cryptodrilidæ, on the other hand, if the two apertures are separated, they are upon the same segment. In *Microscolex michaelseni*, however, in some specimens at any rate, the apertures must be at least only just not upon consecutive segments, and in other specimens the groove extended well into segment xviii. On segments xvii., xviii. are a pair of rounded papillæ which lie just behind the furrows, separating these segments from the one in front. Sometimes the anterior pair are closer together than the posterior.

The alimentary canal is not provided with a well-developed gizzard; there is a rudimentary one only in segments vi., vii. The œsophagus gradually passes into the intestine, which acquires its full calibre in the xvith. The last pair of hearts are, as is usual with the genus, in the xiith segment. The testes are large and bushy; there are only a single pair of them lying in segment x. Opposite the testes are the conspicuous funnels of the sperm-ducts. I could find neither testes nor funnels in segment xi., where, however, are a pair of large and racemose sperm-sacs.

The spermiducal glands are plainly separable into a glandular and a non-glandular portion. The latter is rather less than one-half of the length of the former and very much more slender. The entire gland is straight and occupies about four segments. It opens in common with an opaque thick-walled sac containing penial setæ. This sac is not so long as, but much stouter than, the muscular end of the spermiducal gland. The sac contained, in a specimen dissected by me, 8 penial setæ on one side of the body. Only two of these, however, appeared to be fully mature. These were to be distinguished from the rest by the fact that the implanted end was curved. In the others this end was broadened out. In the former setæ the free end of the seta tapering gradually to the end was unornamented; in another specimen, however, these setæ were faintly ornamented. I am therefore disposed to think that the ornamentation upon the immature setæ is a mark of their immaturity, the spines being as a rule worn off in the setæ which happen to be in use. A curious difference in the constitution of the two kinds of setæ was shown by treating them with a strong solution of potash: when this reagent was applied, the presumably immature setæ became almost invisible, while the others did not exhibit any changes.

There is nothing worthy of comment concerning the ovaries and their ducts. The spermathecæ are a single pair lying in segment viii. They are oval pouches, each with two symmetrically arranged diverticula, in which alone there appeared to be sperm. The spermathecæ are precisely like those of *Acanthodrilus bovei*.

In the gatherings from Punta Arenas and Uschuia, I found specimens coexisting with the normal form which were shorter (50 mm., 95 segments), and had a single median papilla upon segment xvii. instead of a pair. One specimen, however, had the two pairs of papillæ characteristic of the typical variety; hence I do not separate them as species.

Hab. St. 75, Magellan Straits, Punta Arenas. St. 140, Uschuia, forest. St. 65, Magellan Straits, fresh water. St. 179, Navarin Isl., Porto Toro. St. 165, Puerto bridges.

The resemblance between this species and *Acanthodrilus bovei*, coupled with their occurrence in the same locality, is interesting. This resemblance extends to internal characters. The spermathecæ are similar in both, and in both the intestine begins unusually early, the xviith being the more usual segment. I call attention in the course of this paper to the likeness, more or less pronounced, between other species of *Microscolex* and other species of *Acanthodrilus*.

Apart from these particular likenesses, it is a curious and not wholly intelligible fact that the bulk of the South-American species of *Microscolex* and *Acanthodrilus* agree in that the sperm-sacs are in xi. or in ix. and xi.; this is not a usual position. With this may be compared the fact that the Australian Cryptodrilids frequently agree with the Australian Perichætas in that the sperm-sacs are in segments ix., xii., also not a usual position.

(5) **Microscolex gracilis**, n. sp.

This species might easily be confounded with *Microscolex diversicolor*, at least with the less strikingly-coloured examples of that species. It has precisely the same dark purple colour dorsally, the implantation of the setæ being yellowish white; the end of the body, too, has the quadrangular aspect of the corresponding part of the body in *Microscolex diversicolor*. It is, however, in spite of this superficial likeness, quite a different species.

There were three examples, of which the largest measured 72 mm.; the diameter was 2 mm., except at the clitellum, where it was 3 mm. This individual consisted of 88 segments. It is therefore a long and slender worm; the clitellum is very prominent.

It may be at once differentiated from *Microscolex diversicolor* by the fact that the prostomium is not continued by furrows over the whole of the buccal segment.

The setæ are more or less distant, being divided by equal distances at the posterior end of the body, where the middle line of the segments is ridged. The setæ are here particularly large.

The clitellum occupies segments xiii.–xvi. and is complete.

I could not see any dorsal pores.

The male pores are separated by moderately wide intervals from each other; the orifice is wide and surrounded by a crenate margin.

The first septum separates segments iv./v. Septa ix./xii. are thickened.

The gizzard is well developed; it lies in segment viii.

The nephridia begin in segment ii.; they end in a muscular sac.

The sperm-sacs are in xi., xii. In a specimen investigated by longitudinal sections they occupied segment xi. only. The testes and sperm-duct funnels lie in x.

The spermiducal glands are stout and massive; they have a slightly sinuous course and occupy three segments. The penial setæ are also stout and not particularly long. They are bent like a bow, slightly expanded at the free end, but not ornamented.

The muscular duct, when traced back into the glandular part of the spermiducal gland, is seen to stop abruptly; its lining epithelium suddenly ending and being replaced by the indistinct lining epithelium of the glandular part of the organ. Followed in the other direction, the duct winds about and receives the sperm-duct a considerable distance in front of its external orifice; the latter opens at the end of a papilla, which projects into the interior of the gland-duct, which is at this point widened: it is suggestive of the penis of the Tubificidæ, &c. Further down the duct receives the sac of penial setæ. At the external orifice it widens out into a sac of which the epithelium is more glandular on the ventral surface, being here composed of tall non-staining cells; from this sac a tube lined with a precisely similar epithelium leads to the exterior.

Hab. St. 140, Uschuia, forest.

The most singular feature in the internal organization of this worm is the ovaries: these are positively of enormous size. They are quite as large as the sperm-sacs of the same worm, and occupy a considerable amount of the cœlomic cavity of their segment (the xiiith). Not only are the ovaries themselves thus unusually large—the ova share in the increased size, but although they are very much larger than the ova of the common Earthworms of this country, they do not approach in any way the ova of the aquatic Oligochæta: that is to say, they have not got a great amount of yolk deposited within them—no more, in fact, is present than in other Earthworms. So large are the ova that they are not merely visible to the unarmed eye—this is possible even in the common *Allolobophora*—but they suggest parasitic Gregarines, with which I was disposed to identify the ova until they were submitted to microscopic examination.

The spermathecæ are in the ixth segment, as is almost invariably the case with this genus. A stalked diverticulum opens in common with an oval pouch; the diverticulum has a mulberry-shaped outline, and appears, as in other worms, to be the only receptacle of the sperm.

The minute structure of this diverticulum is also different from that of the pouch: when sections are taken through the periphery it presents the appearance of a compound tubular gland, the tubes being separated from each other by interstitial tissue. The whole diverticulum in fact consists of a much-folded epithelium.

(6) **Microscolex corralensis**, n. sp.

Of this apparently new form I only found a single species in a copious gathering from Corral, Valdivia.

Its length is 40 mm., the diameter 4 mm.; the number of segments a little over 70. In the preserved state this worm is a pale greyish brown, the clitellum being pinky brown.

The prostomium is continued by furrows over the entire buccal segment: these furrows converge posteriorly but do not meet.

The clitellum occupies segments xiii.–xvii., the posterior part of xiii. and the anterior part of xvii. not being invaded by glandular substance. On xii. and xiv. alone the clitellum is complete; on the remaining segments it only reaches the ventral pair of setæ.

The setæ are strictly paired from end to end of the body. On the segments immediately in front of and behind the xviith (which bears the male pores) the ventral pairs diverge from each owing to the tension caused by the rather lateral position of the male pores.

There are dorsal pores, but I am unable to fix the exact segment in which they commence.

Some of the segments in the neighbourhood of the spermathecæ and of the male pores bear genital papillæ. There are a pair on each of segments x., xv., xviii., xix. behind the ventral pairs of setæ, a single median papilla on x., and one transversely elongate papilla on xx., xxi.

The male pores are very protuberant, and, as already mentioned, are rather lateral in position. They are of course upon xvii.

With regard to internal structures, I have had to be careful so as not to unduly injure the single specimen at my disposal. The gizzard is large and conspicuous, and appears to lie in segments vi. and vii. Behind this are seven septa, which are strengthened and lie within each other like a series of cups. The last heart is in segment xii.

The racemose sperm-sacs are in segment xi. I believe that there are only a single pair of testes and sperm-duct funnels in segment x., but am not quite sure.

The ovary (in xiii.) is remarkable for being a very perfectly flat plate ending in a free tip as in *Lumbricus*, which projects beyond any of the ripe ova.

The spermiducal glands are massive and somewhat coiled; they end in a very short and narrow duct. There are penial setæ of considerable length (2·5 mm.), two in number in each bundle. These end in a flattened expansion which has a membranous appearance; for some distance in front of this the seta is so regularly marked and with such deep transverse striæ, that it presents quite the appearance of the flagellum of the antenna of a lobster. It is simply an exaggeration of the striæ generally to be found upon the extremity of penial setæ.

The spermathecæ are in ix. Each is a good-sized pouch terminating in a duct, from which arises a single diverticulum of much the same form as the pouch but smaller.

Hab. St. 47, Corral.

(7) **Microscolex robustus**, n. sp.

This new species of *Microscolex* is represented by a single specimen from Teja Isl., and three from Valdivia, Putabla. This specimen was unfortunately not fully mature, though the immaturity seemed to concern the clitellum only.

It is a moderately large species, less than *M. griseus* or *M. spatulifer* and about the size of *M. dubius*. The coloration is on the same plan as that of *M. diversicolor*; it is not, however, so brilliant as in that species. The area upon which the lateral setæ are implanted is, as in the last-mentioned species, white, while the dorsal surface of the worm is purplish. The length of this individual is 57 mm., the diameter 6 mm.; number of segments 95.

The prostomium is continued over the buccal segment by grooves.

The setæ are paired anteriorly but not strictly; the ventral setæ on segment xiii. are a little closer together than on the preceding segments, this convergence continues until the xvith segment; they begin to diverge on the xviith segment, and by the xxth, which marks the limit of divergence, have got to be wider apart than they are on the anterior segments of the body. They continue to the end of the body without any further change.

I could see no dorsal pores.

The clitellum, as has been already mentioned, was not developed in the type. In an example from Putabla it occupies segments xiv.–xvii.

The gizzard lies in segment vii.

The specially thickened septa are few in number. As a general rule in this and, indeed, in other genera, the thick septa begin with the second septum; in the present species this is not the case; the thickened septa are only two, those separating segments x./xii. The capacity of the xth segment is very limited. The septum which divides it from the segment lying in front is closely applied to septa x./xi. In the narrow room thus formed lie the testes and the funnels of the sperm-ducts.

The racemose sperm-sacs lie in segment xi.

The single pair of spermathecæ are small, perhaps on account of the immaturity of the worm. The form is not particularly remarkable; the sac has a diverticulum not quite so long as itself but narrower.

The spermiducal glands are not particularly large. They are confined to their segment. In the single bundle of penial setæ which I examined, I found three penial setæ of about the same length and general appearance except as regards colour; one of the three setæ was a very pale colour, while the other two were bright yellow. I presume that the first-mentioned seta was immature. All of them end in a bluntish point and are quite unornamented.

Hab. Teja Isl., Valdivia (St. 39). St. 30, Valdivia, Putabla.

From Estancilla (St. 41) was collected a larger individual, which seems to be, though it is difficult to be quite certain, a sexually mature specimen of the same species. This worm is 72 mm. long by 7 mm. in diameter, and consists of 82 segments. The clitellum occupies segments xiv.–xvii. There are a number of genital papillæ; a pair on each of segments ix., xv., xvi., and an asymmetrical one on xiv.; on each of segments xvii. and xviii. there are three papillæ. The spermiducal glands of the mature worm have a warty appearance; the penial setæ are very faintly ornamented with transverse ridges.

(8) **Microscolex diversicolor**, n. sp.

A good many examples of this species were collected in Valdivia, in Chile. It is a worm which has an exceedingly marked coloration, and is therefore always conspicuous in any collection. The colour of the dorsal surface is a bright purplish red, extending on to the sides of the body beyond setæ. The dorsal setæ are implanted in areas which are equally conspicuous on account of the fact that they have no pigment and appear white. In some individuals the colour was much more sombre and there was hardly any indication of the white seta areas.

The largest individual which was measured had a length of 52 mm., a diameter of 3·5 mm., number of segments 60. This was one of the more darkly coloured individuals, which might perhaps be regarded on account of this slight difference as a variety. A more typical specimen (as regards colour) was 32 mm. by 3 mm., with 56 segments. But there is a considerable range in size.

The prostomium completely divides the buccal segment.

The setæ are not strictly paired, but the setæ of the lateral couples are farther away from each other than are those of the ventral. The latter hardly come nearer to each other on the segments in the neighbourhood of the xviith ; the approximation is not marked, as in some species.

The clitellum occupies segments xiii.–xvi., half only of the first and last.

The dorsal pores are present and appear to begin on the clitellum.

The gizzard is large compared to the size of the worm ; in the smaller of the two individuals whose measurements are given above it was in segments vi., vii. In a specimen sectioned longitudinally the greater part of the gizzard was seen to lie in vi. The intestine begins in xvii. Behind the gizzard are a number of septa which, though not greatly thickened, are stouter than those which follow them. The last of these bounds segment xiv. anteriorly.

The last heart is, as usual, in segment xii. The nephridia commence in segment v.

There is only a single pair of testes and funnels in segment x. The sperm-sacs are large and racemose and lie in segment xi. There is also a pair in ix. which are a good deal less obvious.

The spermiducal glands are stout and of the tubular character invariably found in this genus. The muscular duct leading to the exterior is moderately long. The penial setæ (two in a sac) are longish (2·5 mm.) and quite unornamented. The free extremity gradually tapers to a point. The sac of setæ opens in common with the spermiducal gland. The sperm-duct opens just separately on to exterior.

The spermathecæ are in ix. The diverticulum is nearly as long as the pouch, but has a mulberry-like appearance. In sections the diverticulum shows much the same structure that I have described above in *M. gracilis*.

The same locality also produced three specimens of a small *Microscolex* which I was at first inclined to regard as a distinct species. I consider, however, that it is merely a small variety of *Microscolex diversicolor*. The total length of the largest individual is 30 mm., the diameter 2 mm., number of segments 100. It is evidently therefore a more slender worm than the type. The setæ appear to be a little more paired than in the type.

Hab. St. 41, Valdivia, Estancilla. St. 48, Corral. St. 38, Valdivia. St. 36, Valdivia. St. 46, Corral.

Fam. PERICHÆTIDÆ.

Of this family there was but a single specimen in the collection, belonging to the genus *Perichæta*.

(1) **Perichæta sancti-jacobi**, n. sp.

As I have already pointed out, the genus *Perichæta* is far from abundant in South America. Indeed only one species, viz. *P. elongata*, is at all well-known, and that species is by no means exhaustively described. As for *P. dicystis* and *P. tricystis* of Perrier, they are only known by the number of spermathecæ which they respectively possess. The present species may or may not be identical with one of these. In the meantime I give it a new name. The single specimen measured 70 mm. by 5 mm. in breadth. The number of segments is 75. The colour (in alcohol) a greenish brown. The clitellum occupies segments xiv.–xvi. and is complete. There are setæ (about 16) on the last segment of it.

I detected no genital papillæ. There are about ten setæ between the male pores.

The gizzard, as usual, is in segments viii., ix. The intestine begins in xv.

The last heart is in segment xiii.

The sperm-sacs are in segments x., xi., xii.

The spermathecæ are in vi., vii.; each is a pear-shaped sac with a narrow tubular diverticulum ending in a swollen extremity.

The spermiducal glands are solid, though much lobulated. The duct is short and straight, without any terminal sac, which is so frequently present in the species of this genus. There are of course no penial setæ.

Hab. St. 1, Santiago, Quinta normal.

2. Description of a new Species of Crab of the Genus *Hyastenus*. By Prof. ALPHONSE MILNE-EDWARDS. (Communicated by Prof. F. JEFFREY BELL, M.A., Sec. R.M.S., F.Z.S.[1])

[Received March 11, 1895.]

HYASTENUS CONSOBRINUS, sp. nov.

Cette espèce ressemble beaucoup à l'*Hyastenus spinosus*[2]; elle n'en diffère que par des caractères de faible importance et, quand

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[1] Being uncertain as to the exact position of this Crab, I submitted it to the examination of the learned carcinologist who has lately investigated the Crustacea of Cape Horn, and I have been favoured by him with the description which I submit to the Society.

[2] A. Milne-Edwards, Nouvelles Archives du Muséum, Mémoires, t. viii. p. 250 (1872).

on aura pu examiner un certain nombre d'exemplaires, peut-être reconnaîtra-t-on que ces particularités ne sont pas constantes et qu'elles varient suivant les individus.

La carapace est pyriforme et épaisse, renflée dans la région gastrique, couverte, ainsi que les pattes, de poils en hameçons qui accrochent et retiennent des Spongiaires et des Alcyons de manière à cacher complètement l'animal. Le rostre frontal est formé de deux cornes divergentes, droites, pointues, dirigées en avant. Leur longueur chez la femelle égale environ la moitié de celle de la carapace. L'angle préorbitaire est peu saillant; le bord sus-orbitaire porte une profonde fissure. La région gastrique est surmontée de deux épines médianes: l'antérieure est la plus longue, elle est acérée et dirigée en haut et en avant; la postérieure est peu élevée et tuberculiforme. Le sillon séparant cette région des régions cardiaque et branchiale est large et superficiel. Une corne latérale existe sur chacun des lobes postbranchiaux. Le lobe urocardiaque est armé d'un gros tubercule pointu qui ne dépasse pas en arrière le bord de la carapace.

L'article basilaire des antennes externes est renflé à sa base et se rétrécit beaucoup vers son extrémité; la tigelle mobile est cachée sous la corne frontale.

Les pinces de la femelle sont faibles, leur extrémité atteint le milieu des cornes rostrales. Les pattes de la 2me paire sont longues, celles de la 3me paire se terminent au niveau de l'articulation de la jambe et du pied des pattes précédentes.

L'abdomen est large et bombé, les 3me, 4me et 5me articles sont soudés.

	m.
Longueur totale de la carapace et du rostre ..	0·045
Longueur des cornes rostrales	0·015
Largeur de la carapace en avant des cornes latéro-postérieures	0·020
Longueur de la patte de la 2me paire	0·042
Longueur de la patte de la 3me paire	0·030
Longueur de la patte de la 4me paire	0·027
Longueur de la patte de la 5me paire	0·023

L'*Hyastenus consobrinus* ne diffère de l'*H. spinosus* que par la moindre divergence des cornes frontales et par le faible développement de l'épine urocardiaque.

Expédition du 'Challenger,' Station 306 A (près du détroit de Magellan).

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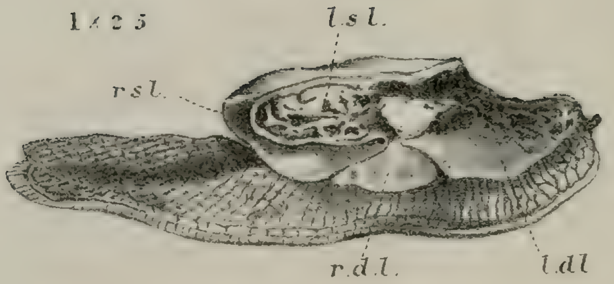
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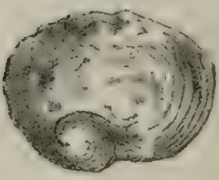

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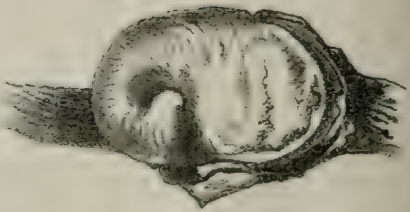

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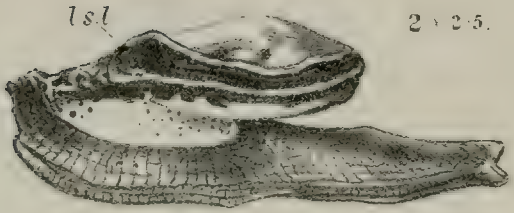

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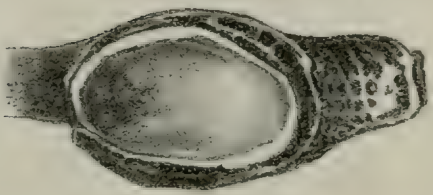

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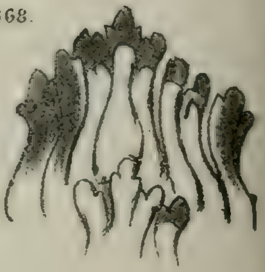

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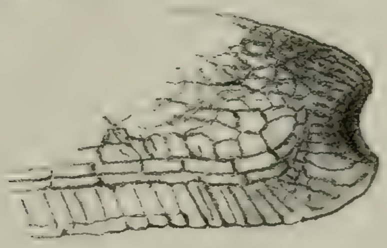

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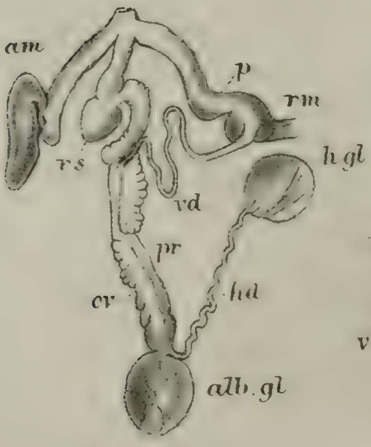

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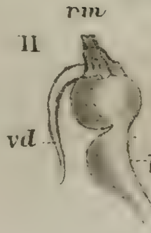

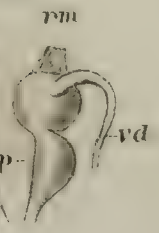

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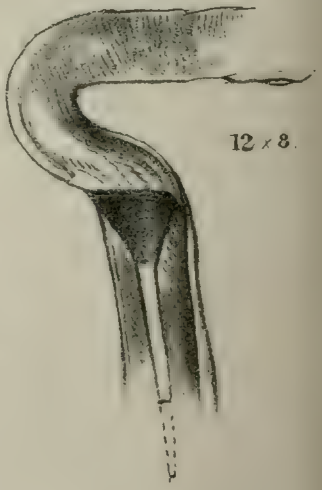

H. H. G. A. del. ad nat. Figs. 1-8 & 12. } J. Smit lith.
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Mintern Bros. imp.

NEW LAND-MOLLUSCS FROM BORNEO.

BRITISH MUSEUM NATURAL HISTORY

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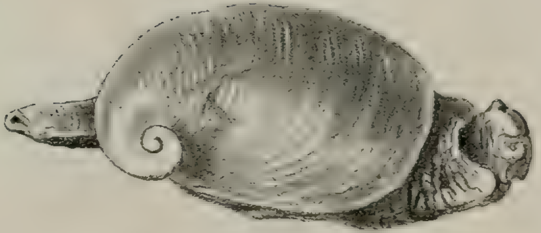

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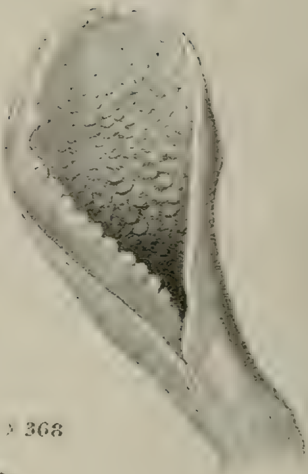

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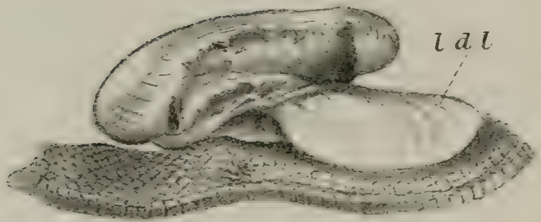

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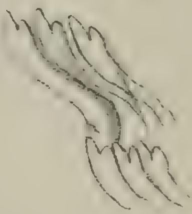

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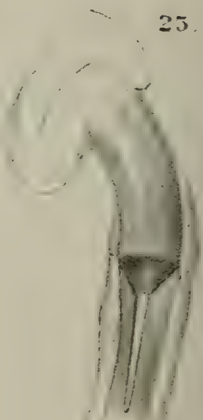

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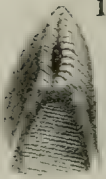

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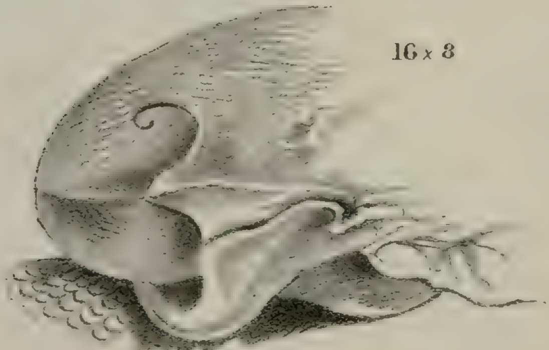

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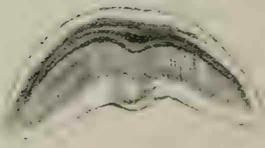

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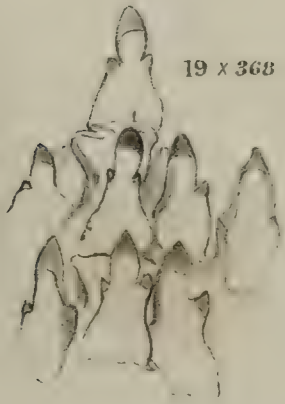

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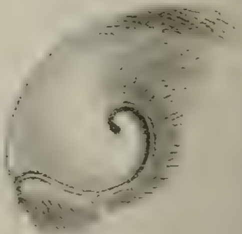

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NEW LAND-MOLLUSCS FROM BORNEO.

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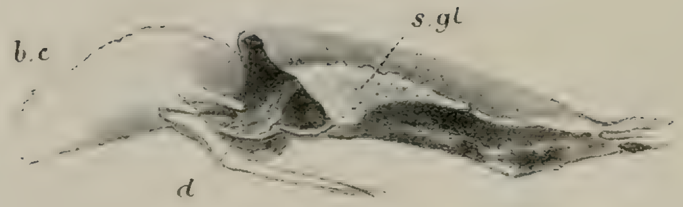

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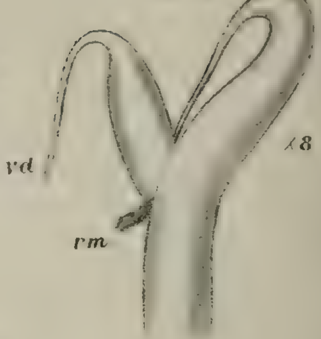

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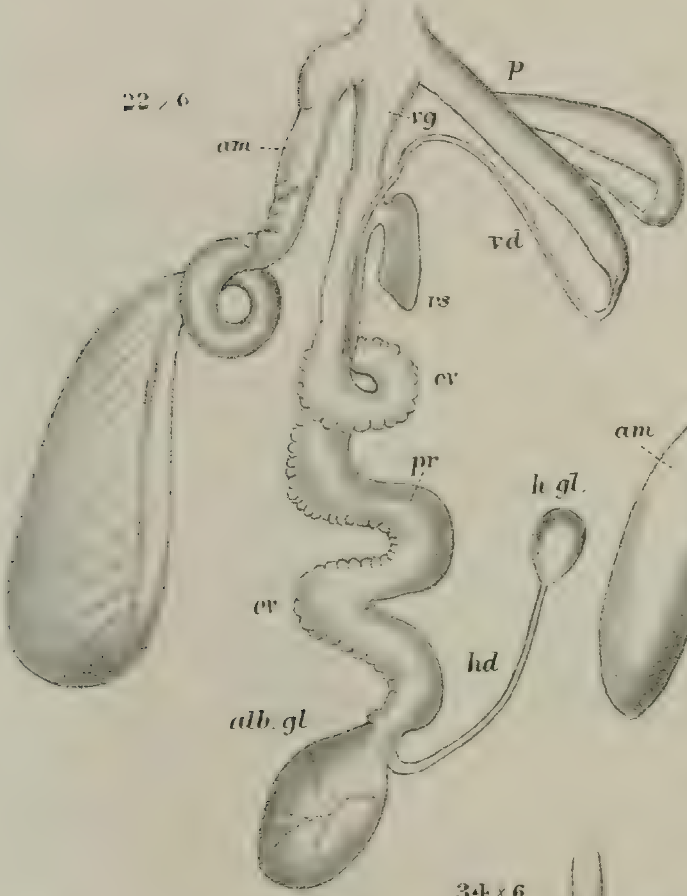

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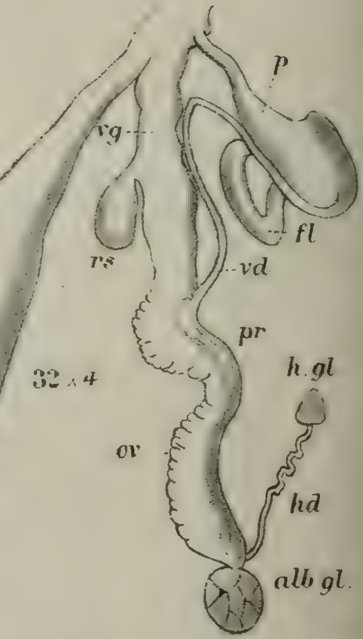

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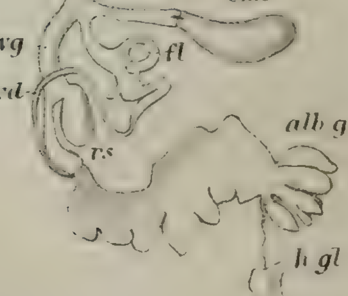

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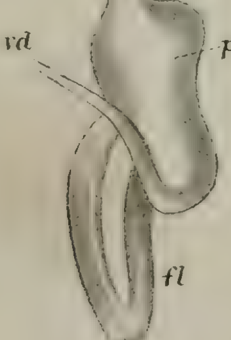

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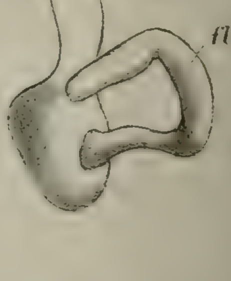

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NEW LAND-MOLLUSCS FROM BORNEO.

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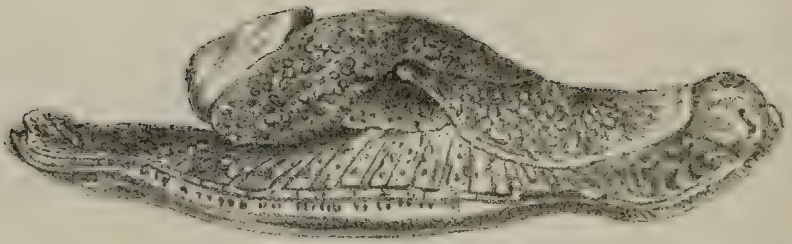

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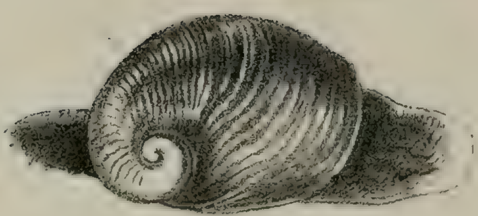

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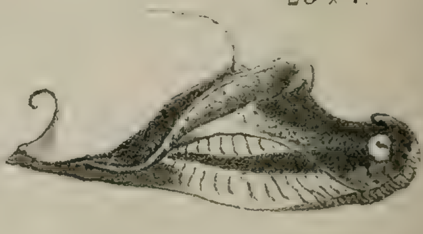

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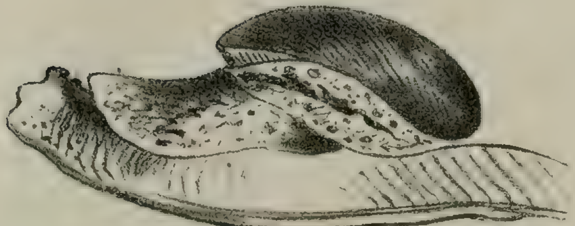

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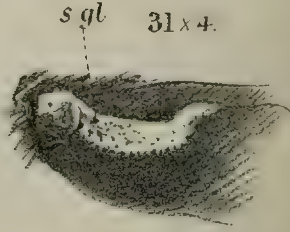

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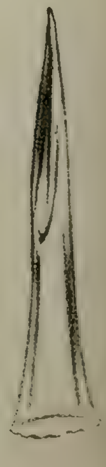

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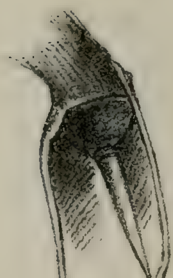

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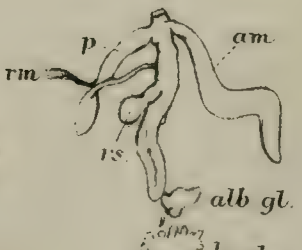

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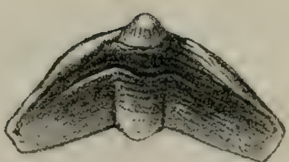

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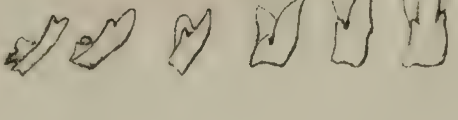

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NEW LAND-MOLLUSCS FROM BORNEO.

3. On the Structure and Affinities of some new Species of Molluscs from Borneo. By Walter E. Collinge, F.Z.S., Assistant Lecturer and Demonstrator in Zoology and Comparative Anatomy, Mason College, Birmingham, and Lieut.-Col. H. H. Godwin-Austen, F.R.S., F.Z.S., &c.

[Received February 28, 1895.]

(Plates XI.–XIV.)

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I. Introduction.

The molluscs which form the subject of this paper were some collected by Mr. A. H. Everett in Borneo and forwarded to Mr. Edgar A. Smith of the British Museum, who very kindly placed them in the hands of one of us (W. E. C.) for investigation.

While fully describing the species, we have thought it necessary and important to treat at some length of the affinities structurally and externally, and to compare them with other genera and species of the Indian and Malayan fauna, upon which one of us (H. H. G.-A.) has worked for some considerable time.

The perfect specimens and the dissected parts have all been placed in the collection of the British Museum, South Kensington.

It is sincerely to be hoped that further Bornean material will be obtained, as there are probably not a few very interesting forms in that region which bridge over the gaps that at present exist between the slug-like molluscs and those possessing a more perfect shell; further, an investigation of their anatomy is likely to throw considerable light upon the relations and position of such genera as *Parmarion*, *Microparmarion*, *Damayantia*, and *Mariella* on the one hand, and *Girasia*, *Austenia*, *Ibycus*, and *Macrochlamys*, &c. on the other.

DAMAYANTIA, Issel, 1874.

II. DAMAYANTIA SMITHI, n. sp.

Shell (fig. 4) broadly oval, with a slight indication (a mere impression) of the apical whorl, the whole of an equally membranaceous and thin texture, transparent, shiny; when removed from the animal in alcohol it becomes much contracted by wrinkling, in the fresh state it would be convex in outline and of a pale olivaceous colour.

Major diameter about 12 millim.

Animal (figs. 1–3).—Ground-colour pale ochre in alcohol, tentacles black or very dark blue, a very dark blue or black streak runs along the side of the foot posteriorly, crossing it diagonally downwards to the mucous pore. The dorsal lobes are streaked and mottled with jet-black on a yellowish-grey ground, this being more conspicuous anteriorly. The black markings on the shell-lobes are concentrically arranged as regards the edge of the shell: in the specimens examined they are probably much contracted, but in life would cover the greater portion of the shell; they are probably very similar in size to those of *Damayantia dilecta*, Issel (**4**. pl. iv. figs. 5, 6).

The mantle differs very much from that of the typical *Girasia* (**1**); in this Bornean slug the left shell-lobe has been developed to a greater extent than the right, and extends back behind the respiratory orifice, even posterior to the apex of the shell, and it is clearly defined by the white edging. On the left anterior margin a cicatricial line marks very distinctly where the shell and dorsal lobes meet. The left and right are continuous all round, the left being the larger and concealing the head of the animal. The foot posteriorly is long and narrow, sharply keeled, and terminates abruptly. Foot-sole divided into three distinct planes, faintly marked with transverse lines, colour yellowish brown. Foot-fringe slightly darker than the foot-sole; two rows of elongated rugæ arranged in parallel rows lie above the foot-fringe. Large linear mucous pore (fig. 6) not extending to the foot-sole. The pallial margin is well marked, as is also the pallial line, which is deeply crossed by grooves into oblong spaces.

The animal in alcohol measured 28 millim. in length, breadth of foot-sole in the anterior region 4½ millim.

Hab. Poeh Mountain (3500 ft.), Sarawak (*A. H. Everett*).

It gives us much pleasure to associate with this most interesting mollusc the name of Mr. Edgar A. Smith, F.Z.S., of the British Museum.

1. *Anatomy.*

Visceral Mass, &c.—On removing the shell, the visceral mass presents a single coil (fig. 5), the apical portion being distinct and terminating bluntly.

The jaw (fig. 7) is straight and narrow, very slightly concave on the cutting-edge, with a straight central portion less than one-third of the whole breadth. The lingual ribbon (fig. 8) is broad and square, having a great number of equal-sized and similarly-shaped teeth in the row. The lingual ribbon was incomplete in the specimen examined, but the following were counted:—175—1—175. The central tooth is elongate with three points close upon the same level, *fleur-de-lis* in form, contracting below this and widening again at the base. The succeeding lateral teeth are all uniform, curved, very elongate, with two closely-set points, the outermost being rounded and the innermost sharp and pointed.

Generative Organs (figs. 9–12).—From the somewhat large thick-walled vagina the penis passes off; its first third is a thick muscular-walled tube which dilates into a more sac-like portion, above which it becomes suddenly constricted, and then dilates into a bulbous head (figs. 10 & 11). Attached to the upper portion of the penis, above the vas deferens, is a short but strong retractor muscle (figs. 10 & 11, *r.m.*). From the side of the bulbous head of the penis the vas deferens passes off as a thick tube narrowing gradually as it approaches the prostatic portion of the common duct. The free oviduct commences immediately above the opening of the receptaculum seminis, this latter organ opening into the vagina; it is a small ovoid sessile body (fig. 9, *r.s.*). The first portion of the free oviduct (fig. 9, *ov'.*) is thrown into a series of constrictions. The oviduct is a wide tube and densely folded, the prostatic and oviducal portions terminate in a bulbous head lying immediately in front of the globular albumen-gland. The hermaphrodite gland is almost circular and appeared flattened, showing a slight fold or indentation in the centre. The amatorial organ is a large, wide, thick, muscular-walled tube, making a single coil above the middle half, which would increase its elasticity and act like a spiral spring; just below this is the calcareous dart. Its basal portion is funnel-shaped, the dart itself being long and pointed (fig. 12).

2. *Affinities.*

Damayantia smithi is in every way a most interesting species, differing in many important particulars from *Girasia* and its allies of the Indian Region, of which the following may be mentioned:—

1. The spiral form of the visceral mass is very noticeable, and we probably have here indicated a relationship with forms having a more perfect spiral shell. In *Girasia*, when the shell is removed, this is not apparent.

2. The form of the mantle-lobes indicates a relationship to some form in which the left shell-lobe has become largely developed along the whole mantle-edge together with the right, as displayed in *Girasia* and *Macrochlamys*, but in which last-named the development of the shell-lobes has been more equal and commenced at two distinct points.
3. The position and form of the caudal mucous gland.
4. The straight jaw.
5. The broad lingual ribbon and great number of teeth of a very different form.

While not inclined to attach any great importance to these two last-mentioned characters, we consider them of sufficient value to place this mollusc in the subfamily *Durgellinæ*.

On comparing *Damayantia smithi* with *Tennentia philippinensis*, Semper (**6**), we find it differs in the presence of the coil in the amatorial organ and in the form of the central tooth. The separation between vagina and free-oviduct also differs. *Tennentia* is probably synonymous with Issel's genus. It was founded by Humbert on a species from Ceylon, viz. *T. thwaitesi*, which is only a synonym of *Mariella dussumieri*, Gray, said to be from Mahé in the Seychelles. The genus *Dekhania*, Godwin-Austen, type *beddomei*, G.-A., is also the same as *Mariella* and must be suppressed.

Issel (**4**) in 1874 figured and described three species of slugs from Sarawak, one of which, *dilecta*, is the type of a new genus founded by him, viz. *Damayantia* (**4**. figs. 4 & 6), on external characters only. This is shown to have exactly the same peculiar concentric markings on the mantle as *Damayantia smithi*, and in spite of the statement of Issel that there is no shell, we believe them to belong to the same genus. These very thin membranaceous shells may easily escape notice; and, further, in all the species from the Indian region, to which one of us (H. H. G.-A.) has devoted special attention, a shell is always present, however small and membranaceous in size and texture it may be reduced to.

The two other species recorded by Issel are *D. doriæ* (pl. iv. figs. 7 & 8) and *D. beccarii* (pl. iv. figs. 9, 10, & 11). The latter has a thin immature shell (fig. 10), but the jaw figured (fig. 11) has a strong central projection. Issel has placed them in the genus *Parmarion*.

MICROPARMARION, Simroth, 1893.

III. MICROPARMARION POLLONERAI, n. sp.

Shell (fig. 13) flat and expanded, auriculate, the apex white, shelly, the rest olive-green, membranaceous yet solid; two whorls.

Major diameter 16 millim., minor diameter 10 millim.

The posterior side of the shell is very thin and diaphanous and falls around the edge of the shell, covering the side of the visceral mass. In this respect it recalls the shell of the South Indian *Africarion palleus*, "Morel.," G.-A.; but here the similarity ceases, and the extremity of the foot and the hollow in which the body rests are quite different.

Animal (figs. 14–16), in alcohol, of a bluish[1]-grey colour, dorsum dark blue. The foot-sole is divided into a median and two lateral planes, the former being yellow; the lateral planes were probably much darker—a dark blue or sepia—when received they had a dark green appearance, which has gradually faded as fresh alcohol has been added. Foot-fringe deep and well marked, lineoles chocolate-brown. The extremity of the foot is truncate. Mucous pore a narrow vertical slit (fig. 15) not extending to the sole of the foot. The mantle-lobes are yellowish brown in colour and smaller than in *Damayantia smithi*, extending around and over the margin of the shell, but leaving a large portion visible. It is almost impossible to remove the shell without tearing away the flat and more solid upper surface of the last whorl, which really forms the first whorl, from the apex and the thin membranaceous covering at the back, because the apical portion, as will be seen from the figures (figs. 16 & 17), holds the posterior end of the visceral sac, which forms a large and distinct closely wound spiral.

Habitat. Paka Paka, Kina Balu (10,000 ft.), on leaves (*A. H. Everett*).

We have named this species after Signor Carlo Pollonera, the distinguished Italian malacologist of Turin.

Microparmarion pollonerai at first sight may appear to be not unlike *Damayantia smithi*, but the shell is far better developed, with a corresponding reduction of the shell-lobes, and the colour of the posterior portion and foot-sole differs also.

1. *Anatomy.*

Visceral Mass, &c.—The salivary glands (fig. 21) lie one on either side of the œsophagus. The jaw (fig. 18) is strong and solid, well arched above, with a large central projection on the cutting-edge, which is very slightly concave. The lingual ribbon (figs. 19 & 20) has the formula

$$60—25—1—25—60$$
$$85—1—85.$$

The centre tooth has two cusps at the base of the centre point; the median teeth are large and broad, with an outer basal cusp, the succeeding laterals being much curved and more equally bicuspid.

Generative Organs (figs. 22, 23, 24, 25).—There is a wide sac-like vagina from which arises the receptaculum seminis, a somewhat irregular-shaped sac. As in *Damayantia smithi*, there is no duct. The penis is a thick elongated muscular sheath; the vas deferens passes off as a narrow tube from the posterior end, in life it lies along the inner side of the penis and on the side of the vagina and free oviduct. The retractor muscle has its attachment some little distance below this, close to the point where the thickened flagellum (calc-sac) terminates (fig. 23). The interior lining of the flagellum has a beautifully papillated surface (fig. 24), the raised portions being renate in form and directed forwards, somewhat like the teeth of a coarse file. The prostatic and oviducal canals, forming the common duct, are thrown into a series of sharp folds, which are not without some difficulty unwound. The albumen-gland is large and somewhat pyriform in shape. The hermaphrodite gland is a small oval-shaped body with a short thin tube attached—the hermaphrodite duct. The amatorial organ (fig. 22) has a sharp coil about midway in its length, with the large swelling glandular mass above; immediately below the coil, where the sheath narrows, is a calcareous dart (fig. 25) funnel-shaped at the base.

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[1] Wherever a green colour was present in the alcoholic specimen, it is here spoken of as blue.

IV. MICROPARMARION SIMROTHI, n. sp.

Shell (fig. 28) oval in form, solid, olivaceous amber-colour, the lines of growth very strongly and regularly marked; apex small, white with a deep suture. There is an indication of its having had two and a half whorls when very young, the last whorl being covered again by the more mature and later formed shell of the last whorl.

Major diameter 17 millim., minor diameter 10 millim.

Animal (figs. 26 to 29). Colour variable, posterior portion mottled with chocolate and brown; median region yellowish brown; anterior and dorsal regions similar, with two very conspicuous black bands, one on either side of the head, separated from a central black band, which passes between the tentacles over the head, by pale lines running from the base of the tentacles. The sides of the head and foot are mottled and spotted; mantle also, but to a much greater extent. Shell-lobes closely papillated. Foot-sole divided into three planes, of which the median one is the largest, all marked with faint transverse lines; foot-fringe marked with broad chocolate-brown lineoles. Immediately above the foot-fringe is a distinct line or groove, which marks off the whole of the upper portion of the animal from the foot-sole (fig. 29).

Length in alcohol 31 millim., breadth of foot-sole in the anterior region 5 millim.

Habitat. Paka Paka, Kina Balu (10,000 ft.), on leaves (*A. H. Everett*).

With this species we have associated the name of Dr. Heinrich Simroth, the distinguished malacologist of Leipzig, and founder of the genus.

1. *Anatomy.*

Visceral Mass, &c.—The salivary glands are similar to those described in *Microparmarion pollonerai*, as are also the jaw and form of the teeth. The lingual ribbon was extracted in a very perfect state, showing one hundred rows of teeth arranged thus

90—16—1—16—90
106—1—106.

Generative Organs (figs. 32–35).—The vagina is larger than in *M. pollonerai*, as is also the sessile receptaculum seminis, which is somewhat pyriform in shape. The penis opens into the vestibule as a comparatively narrow tube, but as it approaches the vas deferens it dilates into a large sac-like head, from which the flagellum arises; the latter organ is looped back upon itself and of the same diameter throughout, terminating blindly. In one specimen it was somewhat produced, as shown in figure 34. The vas deferens leaves the head of the penis as a wide tube, becoming narrower in the middle and dilating again previous to entering into the prostate. The common duct is similar to that in *M. pollonerai*, only not so richly convoluted; it differs also in being much straighter and not coiled upon itself as in *M. pollonerai*. The albumen-gland is small and ovoid. The hermaphrodite gland is small and triangular in shape, with a thin convoluted duct.

2. *Affinities.*

The nearest species as regards internal anatomy to either of these two species of *Microparmarion* is *Parmarion pupillaris*, Humb., from Java, notwithstanding the fact that the shell is very rudimentary. It is figured by von Martens (**5**. pl. xii. fig. 3), who localizes *Parmarion* to this part of the world. The generative organs are figured by Semper (**6**), whose figure we have reproduced for purposes of comparison. The form of the penis and receptaculum seminis and amatorial organ are very different from those in either of the species here described. The dart is cut off like a pen near the point (fig. 37). In the jaw and lingual ribbon there is a complete analogy.

A comparison, however, of all the characters with those of *Girasia* of India and Burma shows that these Malayan forms differ sufficiently to constitute them a distinct race; and if we could only obtain more material, in which other characters, such as the spermatophore, might be examined, a still greater divergence would, we think, be found associated with the small sessile receptaculum seminis.

Simroth (**7**), in his latest paper on these slug-like land-molluscs, very rightly divides the genus into two, viz., *Parmarion* and a new genus *Microparmarion*, distinguishing this latter by the sessile receptaculum seminis and solid *sagitta amatoria*. It will be seen that among the Javan forms figured by him on plates vii. and viii., *Microparmarion strubelli* agrees in some respects with *M. simrothi*, particularly in the calc-sac of the male organ and in the hard calcareous dart rising from the funnel-shaped base, and externally by the black lines on the dorsum and region of the head. In

M. pollonerai there is a tendency to change, as shown in the twisted amatorial organ and the form of the calc-sac.

V. SUMMARY AND CONCLUSION.

The chief features on which we would base the specific distinctness of the afore-mentioned new species are as follows:—

1. DAMAYANTIA SMITHI.

D. dilecta, Issel, at present being known only from external features, we would point out that it differs from our species externally in the form and size of the mantle-lobes, the lesser development of the left lobe, and presumably in having a smaller and less solid shell than that possessed by *D. smithi.*

2. MICROPARMARION POLLONERAI.

The form, size, &c. of the penis and calc-sac are quite sufficient to separate this species from any already described. The densely convoluted common-duct and the sharp coil in the amatorial organ are also characteristic of this species.

3. MICROPARMARION SIMROTHI.

M. strubelli, Simr., is undoubtedly the nearest ally to *M. simrothi.* For purposes of comparison we have reproduced Simroth's figure (7. tab. viii. fig. 12) on fig. 39, and it will be seen that our new species differs from the former in the following details:—

a. The larger and more perfect shell.
b. The different form of the penis, albumen-gland, and hermaphrodite gland.
c. The almost straight common duct (prostate and oviduct).
d. The large amatorial organ.
e. Less important differences in the form of the flagellum, vagina, and free oviduct.

There is, as one might expect, considerable similarity in these Bornean slug-like forms. This is shown in so many important organs, wherein they differ from the slugs of the Indian region, notably in the form of the dart, short sessile receptaculum seminis, and differently formed male organs, which would materially alter the form of the spermatophore. But perhaps the most interesting result of the examination of these slug-like molluscs is their similitude internally to the similar parts of shell-bearing species which inhabit the same island of Borneo. A reference to the figures and description of the genera *Everettia* and *Dyakia* (2) will show that the calcareous dart peculiar to *Microparmarion* occurs in both of these genera, while the odontophore of *Damayantia smithi* agrees with that of *Dyakia* in a remarkable manner.

It seems to us that there can be little doubt but that the slug-like forms of Borneo have the same close relationship to the shell-bearing molluscs among which they are now found living, as the

Indian forms bear to *Macrochlamys* and allied shell-bearing genera, and any true attempt at classification must be based on these lines, and would place a wide gulf between *Girasia* and *Austenia* on the one side, and *Parmarion* and *Microparmarion* on the other. Further, we think that future research will clearly show that many of the slugs cannot rightly be placed in families by themselves, but will find their true position before or after the genera they have descended from or developed into.

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VII. DESCRIPTION OF THE FIGURES.

PLATES XI.–XIV.

Fig. 1. *Damayantia smithi*, n. sp. View from right side. × 2·5.
2. *Damayantia smithi*, n. sp. View from left side. × 2·5.
3. *Damayantia smithi*, n. sp. View from above. × 2·5.
4. Dorsal view of shell. × 2·5.
5. Visceral mass, showing spiral fold, *sp.f.* × 2·5.
6. Caudal mucous pore. × 8.
7. Jaw. × 12.
8. Portion of lingual ribbon. × 368.
9. Generative organs. × 2·25.

Lettering.

alb.gl.	Albumen-gland.	*ov.*	Oviduct.
am.	Amatorial organ.	*p.*	Penis.
d.s.	Dart-sac.	*pr.*	Prostate.
f.	Flagellum.	*r.m.*	Retractor muscle.
h.d.	Hermaphrodite duct.	*r.s.*	Receptaculum seminis.
h.gl.	Hermaphrodite gland.	*r.s.l.*	Right shell-lobe.
l.d.l.	Left dorsal lobe.	*v.*	Vestibule.
l.s.l.	Left shell-lobe.	*v.d.*	Vas deferens.
ov'.	Free oviduct.	*vg.*	Vagina.

Figs. 10 & 11. Upper portion of penis, from both sides. × 3.
Fig. 12. Dart-sac and dart *in situ*. × 8.
13. *Microparmarion pollonerai*, n. sp. Dorsal view. × 2·4.

Fig. 14. *Microparmarion pollonerai*, n. sp. View from right side, showing right and left dorsal lobes of the mantle, *r.d.l.* and *l.d.l.* × 2·4.
15. Caudal mucous pore. × 4·6.
16. Visceral sac, dorsal view: *r.s.l.*, right shell-lobe. × 8.
17. Visceral sac, lateral view. × 8.
18. Jaw. × 12.
19. Portion of lingual ribbon. × 368.
20. Portion of lingual ribbon. × 368.
21. Portion of stomach and intestine, showing position of salivary gland, *s.gl.*, and its duct, *d.*, opening into the buccal cavity, *b.c.*
22. Generative organs. × 6. Lettering as before.
23. Penis and flagellum. × 8.
24. Interior portion of flagellum, showing the papillated surface. × 4.
25. Dart-sac and dart *in situ*.
26. *Microparmarion simrothi*, n. sp. View from the right side, showing the position and extent of the right and left dorsal mantle- and shell-lobes. × 4.
27. *Microparmarion simrothi*, n. sp. Anterior portion from the left side. × 3.
28. Shell of the same. × 2.
29. Head and anterior portion of the same. × 4.
30. Jaw. × 4.
31. Visceral mass, showing salivary gland, *s.gl.* × 4.
32. Generative organs. × 4. Lettering as before.
33. Upper portion of penis with flagellum. × 6.
34. The same, showing a variation in the form of the flagellum. × 6.
35. Dart-sac and dart *in situ*. × 12·5.
36. Generative organs of *Parmarion pupillaris*, Humb. (after Semper). Lettering as before.
37. Dart of *P. pupillaris*, Humb. (after Semper).
38. Isolated teeth from lingual ribbon of *P. pupillaris*, Humb. (after Semper).
39. Generative organs of *Microparmarion strubelli*, Simr. (after Simroth). Lettering as before.

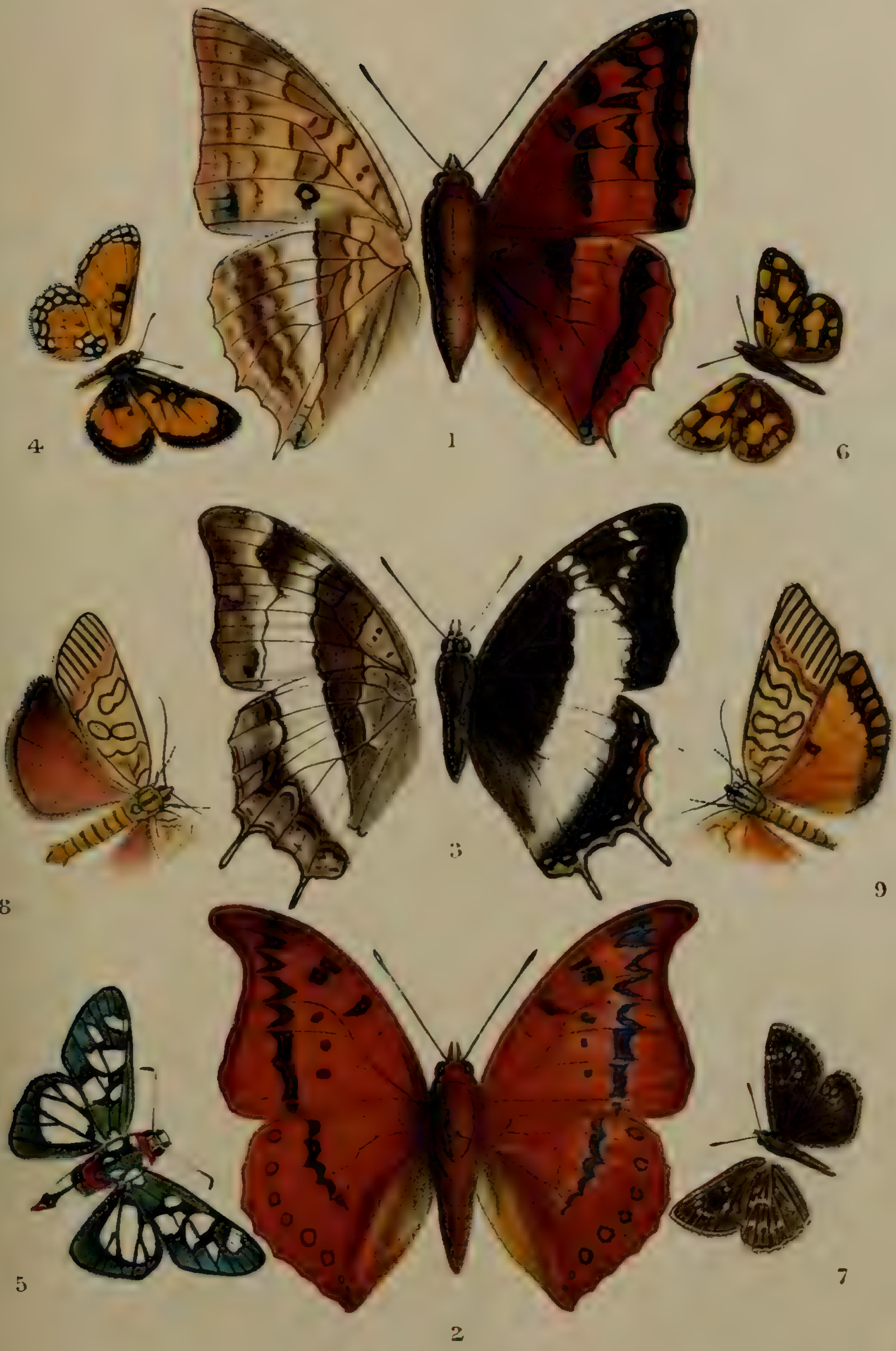
4. On Collections of Lepidoptera from British Central Africa and Lake Tanganyika. By ARTHUR G. BUTLER, Ph.D., F.L.S., F.Z.S., &c.

[Received March 12, 1895.]

(Plates XV. & XVI.)

In 1894 we received, through Mr. A. Whyte, F.Z.S., a small collection of Lepidoptera made at Zomba by Mr. J. McClounie, especially remarkable for the number of specimens of the genus *Charaxes* which it contained. Among these were specimens of the female of *C. whytei* (the male of which I had described and figured in the Society's Proceedings for 1893), of two previously unnamed forms, possibly distinct species, and of two undoubtedly new species, also examples of *C. nyasana* confounded by the late Mr. Hewitson with his *C. azota*.

A second series has been selected from a large consignment of Lepidoptera collected at Fwambo, Lake Tanganyika, by Mr. Alexander Carson. This is especially interesting, not only as including examples of rare species previously only received from Zomba



F. W. Frohawk del. et lith.

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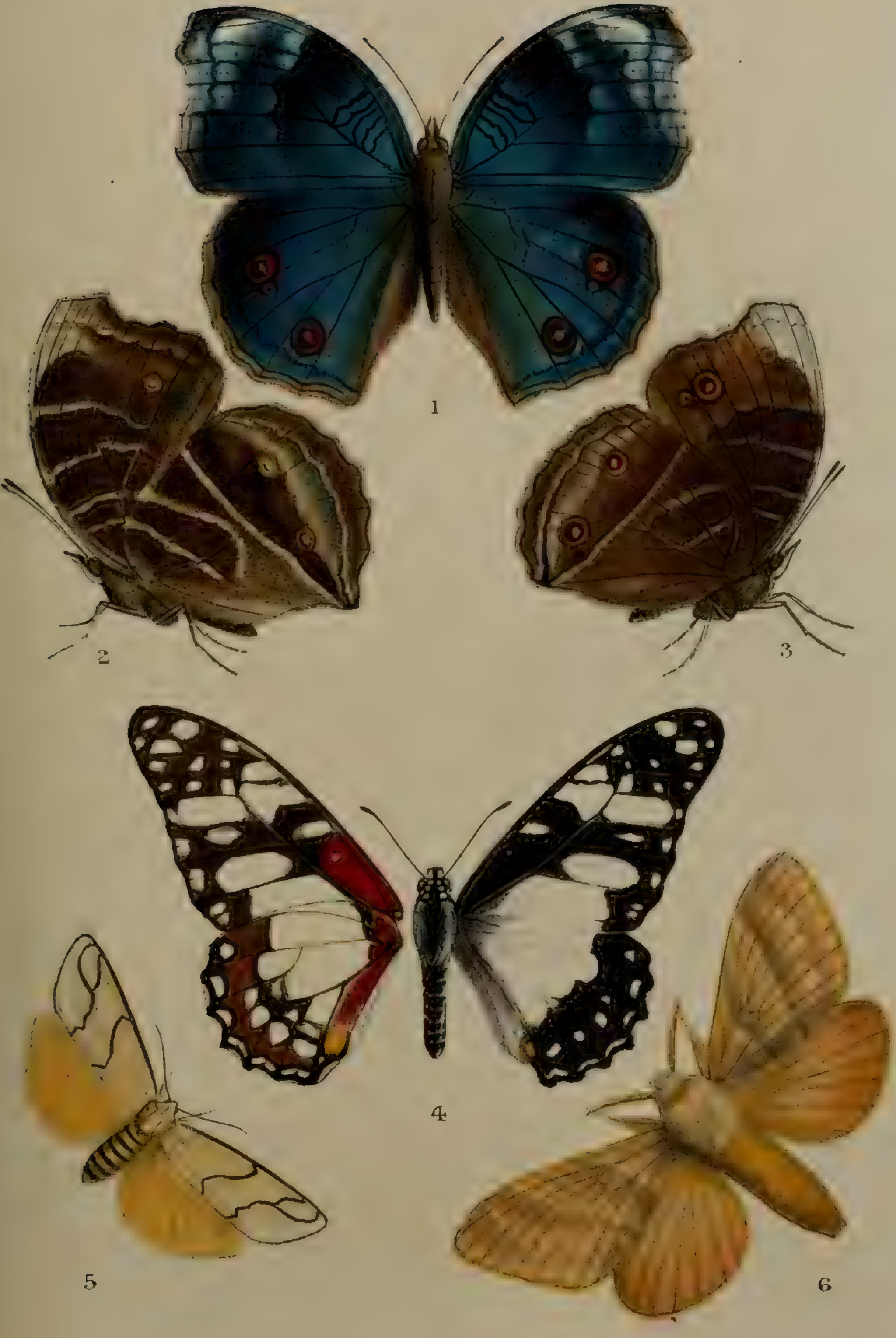
NEW LEPIDOPTERA
FROM BRITISH CENTRAL AFRICA.

BRITISH MUSEUM



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NEW LEPIDOPTERA
FROM BRITISH CENTRAL AFRICA.

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and Lake Mweru, but several most startling novelties, the first of which is *Junonia pavonina*; a lovely new species allied to *J. artaxia*. Another very interesting Butterfly in the collection is the female of my *Crenis crawshayi*, clearly proving its distinctness from the allied *C. concordia* of Hopffer. Among the Moths of Mr. Carson's collection is one belonging to a beautiful new genus of *Lithosiidæ* bearing a most striking resemblance, in the disposition of its colours and somewhat complicated pattern, to the Agaristid genus *Pais*: examples of the beautiful Noctuid moth *Calliodes glaucescens*, previously received from Zomba only, were also among those obtained.

The following is a list of the species of which specimens were acquired:—

RHOPALOCERA.

1. AMAURIS WHYTEI.

Amauris whytei, Butler, P. Z. S. 1893, p. 644.

♀, Zomba.

2. MELANITIS LIBYA.

Melanitis libya, Distant, Ann. & Mag. Nat. Hist. ser. 5, vol. x. p. 405 (1882); Trimen, P. Z. S. 1894, p. 22, pl. iv. fig. 2.

♂, Zomba.

3. MELANITIS SOLANDRA.

Papilio solandra, Fabricius, Syst. Ent. p. 500 (1775).

Zomba.

4. SAMANTA PERSPICUA.

Mycalesis perspicua, Trimen, Trans. Ent. Soc. London, 1873, p. 104, pl. i. fig. 3.

Fwambo.

5. CHARAXES CASTOR, var. FLAVIFASCIATUS.

The Eastern and Central African race of *C. castor*; having the upper-surface coloration of *C. hansalii*, with the general marking of the type form, from which the width of the central band principally distinguishes it; on the under surface, however, the dark markings on the basal half are greenish grey, there is a black transverse spot on the wider central white band, and the deep red band is clearly broken up into spots by whitish nervular streaks. Expanse of wings 4 inches to 4 inches 4 lines.

Zomba.

6. CHARAXES SATURNUS.

Charaxes saturnus, Butler, P. Z. S. 1865, p. 624, pl. 36. fig. 1; ♀, Lep. Exot. i. p. 5, pl. 2. fig. 2 (1869).

♂, Zomba.

In the same collection is the female of a male insect which I have considered since 1893 to be a variety of *C. saturnus*, but respecting which I now have some doubt. We received the male from Sulim bin Najimb, Konde, where it was obtained by Mr. R. Crawshay. It differs from the typical form in the more falcate character of the primaries (particularly in the female), the lighter, redder basal area of the wings above, the clearer colouring of the postmedian tawny band, and the smaller black spots which traverse it; the marginal markings on all the wings extended inwards so as to form a broad band, divided into truncated ovoid tawny spots in the primaries and in the secondaries barely separated by the black veins into eight spots—the three first tawny, bell-shaped or obconical, slightly tipped at the outer angles with white, the fourth white with orange fold, the fifth and sixth similarly coloured but quadrate internally; the two last green varied with white and lavender, connate in the female; all the tawny spots below larger and of a more salmon tint, the grey-greenish markings on basal area with more slender white margins. Expanse of wings, ♂ 3 inches 3 lines; ♀ 3 inches 11 lines.

I think that this may prove to be at least a distinct race, having a restricted range in British Central Africa, and therefore I propose to call it var. *laticinctus*. We received a third example in the Salvin and Godman collection.

7. CHARAXES DRUCEANUS.

♂. *Charaxes druceanus*, Butler, Cist. Ent. i. p. 4 (Oct. 1869); Lep. Exot. p. 26, pl. x. fig. 4.

♀, Zomba.

The female is slightly larger and has a broader tawny band than the male.

8. CHARAXES POLLUX.

Papilio pollux, Cramer, Pap. Exot. i. pl. xxxvii. figs. E, F (1776).

♂, Zomba.

9. CHARAXES MACCLOUNII, sp. n. (Plate XV. fig. 1.)

♂. Allied to *C. lasti*: primaries with less arched costa, less sinuated outer margin, and shorter inner margin; secondaries strongly produced at anal angle, with only two tails, the first of which (at extremity of third median branch) is a mere denticle, the second (at extremity of first median branch) barely half the length of that in *C. lasti*; colouring deeper throughout, with all the black markings considerably heavier, the discal spots of primaries continued to below first median branch, those of secondaries forming a continuous tapering submarginal band; under surface altogether more ochreous than in *C. lasti*, the markings mostly ferruginous, the black-bordered grey markings on interno-median area of primaries reduced in size, the silver band of secondaries widened out as in *C. cynthia*. Expanse of wings 80 millim.

♀. Extremely like Mr. Trimen's figure of *C. lasti* ♀ (P. Z. S. 1894, pl. v. fig. 6), but altogether deeper in colour, the black markings heavier, the macular submarginal band much wider, reducing the marginal tawny border of the primaries to a series of oval spots; the secondaries somewhat produced at anal angle, with the inferior tail slightly incurved, but both tails well developed and only slightly shorter than in *C. lasti*: below, the wings are much paler than in the male, the silver band of secondaries being replaced by a broad creamy stramineous belt in continuation of that on the primaries. Expanse of wings 18 millim.

Two pairs, Zomba.

This species is intermediate in character between *C. lasti* and *C. cynthia.*

10. CHARAXES BRUTUS.

Papilio brutus, Cramer, Pap. Exot. iii. pl. ccxli. figs. E, F (1782).

♂, Zomba.

The single specimen obtained is distinctly shot with dark bronze-green on basal area and indigo-blue on external area; the white band tapers more than usual on the primaries, the five upper spots being smaller than in most examples. This species is, however, known to vary in all these characters.

11. CHARAXES NYASANA.

Charaxes nyasana, Butler, Ann. & Mag. Nat. Hist. 1895, xv. pp. 248–9.

Charaxes azota, Hewitson, Ent. Month. Mag. xiv. p. 181 (1878).

♂, Zomba.

Hewitson's description of his Nyasa example is insufficient to enable anyone to distinguish it from the true male of *C. azota* from Delagoa Bay: the latter is smaller than examples from Nyasaland, and on the upper surface of the primaries the reddish-tawny border divides above the second median branch, the inner furca consisting of five and the outer of six spots; in the Nyasa form the border divides above the third median branch, leaving only two and a half spots of the inner furca free; the remaining divisions of the border are also marked with black spots: on the secondaries the outer red area occupies nearly half the wing in the male from Delagoa Bay, but in *C. nyasana* only two-fifths, in the former the inner edge of this border is nearly straight; in the latter it is zigzag. On the under surface the shiny glaucous lilacine central band in *C. nyasana* is of double the width of that in *C. azota*: expanse of wings in the former 95 millim., in the latter 87 millim.

C. calliclea, H. G. Smith, is an intermediate race.

12. CHARAXES LEONINUS, sp. n. (Plate XV. fig. 2.)

Allied to *C. nichetes*, similar in form. Above deep orange, tawny in the male, paler in the female; a single or double black spot in the cell of primaries just below the subcostal vein, a transverse subcuneiform spot at end of cell, two quadrate spots beyond the cell, and three smaller spots in the median interspaces; a black zigzag discal band, diffused on both sides towards costa and bounding a macular increasing band of the ground-colour, which commences below the last subcostal branch with the first of four tawny spots; below the second median branch, however, this band is much broader and unbroken; apical half of costa, apex, and external border ferruginous: secondaries crossed beyond the middle by a tapering, more or less sinuated black band continuous with the discal band of primaries; a series of annular submarginal ocelloid markings, the first six of which are nearly of equal size, the last two smaller and dotted externally with black pupilled with bluish white in the male, larger but confluent in the female: body tawny, the thorax slightly blackish. Under surface ferruginous, glaucous from the middle outwards, with dark brown markings as in *C. nichetes* on the basal half, traversed beyond the middle by a continuous, nearly straight, slate-black line, followed by an interrupted deep ferruginous zigzag stripe, which becomes indistinct on the primaries and is bounded externally towards the apex of the latter wings by whitish scaling; external border without gloss: secondaries traversed by a series of indistinct small ocelli, the last four of which (between the third median branch and the anal angle) are touched with black and pupilled with blue; immediately beyond these ocelli is a lunulate ferruginous stripe partly confluent with a diffused marginal stripe; in the female all these markings are far less defined than in the male. Expanse of wings, ♂ 75, ♀ 85 millim.

One pair, Zomba.

The allied *C. nichetes* appears to have been described by Dewitz as *C. hamatus*, and *C. ogovensis* by Dr. Holland; I cannot discover any characters by which to distinguish them.

13. Charaxes candiope.

Nymphalis candiope, Godart, Enc. Méth. ix. p. 352 (1823).

♀, Zomba.

The single imperfect example obtained is very peculiarly coloured on the under surface, all the markings on the primaries being much less defined than usual and the secondaries being pearly dove-greyish with mere indications of the whitish markings, the postmedian lunulated band obliterated, but all the veins as usual bright green. This can, I think, hardly be more than an accidental variation, for the pattern of the upper surface is quite normal. *C. viridicostatus* of Aurivillius appears to be the same as *C. candiope*.

14. Charaxes guderiana.

♂. *Nymphalis guderiana*, Dewitz, Nova Acta Akad. Naturf. Halle, 1879, p. 200, pl. 2. fig. 18.

♀. *Charaxes guderiana*, Butler, P. Z. S. 1893, p. 648; Trimen, P. Z. S. 1894, pl. v. fig. 8.

♀, Fwambo.

One brightly coloured female was obtained; males were also in the collection, but were not required for the Museum.

15. CHARAXES ETHALION.

♀. *Charaxes ethalion*, Boisduval, Voy. de Deleg. ii. p. 593 (1847).

♂, Zomba.

The male of this species, though probably often confounded with those of *C. hollandi* and *C. alladinis*, is common in collections.

16. CHARAXES PHÆUS.

♀ as ♂. *Charaxes phæus*, Hewitson, Ent. Month. Mag. 1877, vol. xiv. p. 82.

♂. *Charaxes alladinis*, Butler, P. Z. S. 1893, p. 648.

Now that we have received the type of *C. alladinis* in the Godman and Salvin series, I find that my former identification of the male was incorrect; the latter is a West-African insect with the basal area of the primaries bronze-greenish, marginal spots of the same colour; secondaries with white submarginal spots and a discal lunulate green streak: it appears to inhabit the Cameroons. The male described by me in 1893 is undoubtedly that sex of *C. phæus*.

♂, Zomba.

It is a curious thing that not only did Hewitson describe and Mrs. Monteiro figure two females as sexes of *C. phæus*[1], but Dewitz did the same thing in his attempt to figure the sexes of *C. alladinis*. I would propose the name of *Charaxes rosæ* for Hewitson's supposed female of *C. phæus* (which is well described by Mr. Trimen), its male doubtless would nearly resemble that sex of *C. etheocles*.

It is extremely probable that *Charaxes alladinis* ♀ of Dewitz (Nova Acta Leop.-Carol. Akad. Naturf. i. pl. xvii. fig. 9, 1887) is only a slight variety of *C. rosæ* ♀; but his *Charaxes alladinis* ♂ (fig. 8) is a female allied to *C. ethalion* and may be called *C. dewitzi*, it is perfectly distinct from *C. alladinis*. *Charaxes ephyra*, var., Dewitz (figs. 10–11), are probably the same as Mr. Trimen's recently described *Charaxes manica*, from which the female scarcely differs excepting on the apical border of the primaries: at any rate, without comparing specimens of both species, it would be unsafe to pronounce them distinct.

17. CHARAXES WHYTEI. (Plate XV. fig. 3, ♀.)

♂. *Charaxes whytei*, Butler, P. Z. S. 1893, p. 649, pl. lx. fig. 2.
Charaxes selousi, Trimen, P. Z. S. 1894, p. 45, pl. vi. fig. 10.

♀. Above purplish black, browner on basal area; crossed beyond the middle by a broad pure white belt, which, however, is represented above the median vein of primaries by three elongated white spots; five other spots, sometimes lunate, in an angular series between the same belt and the costa, commencing in the second median interspace: secondaries with two spots immediately beyond and almost touching the belt upon the subcostal and radial interspaces; the inferior extremity of the belt abruptly narrowed; a submarginal series of white spots, or grey spots with white centres, the last two bordered externally with lilac; still nearer to the margin an interrupted blue-edged red stripe changing to olive-green at anal angle. Below, rather more silvery than in the male and crossed by a broad white belt as above, but the angular series of spots on the primaries forming a continuous band, bounding the outer edge of the belt to submedian vein and only divided by the dark nervures; markings beyond the belt on the secondaries better defined than in the male. Expanse of wings 67–69 millim.

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[1] Curiously enough Mr. Trimen has failed to discover this error, which he has repeated in his 'South-African Butterflies,' vol. i. p. 344.

Two females, Zomba.

18. CHARAXES ACHÆMENES.

Charaxes achæmenes, Felder, Reise der Nov., Lep. iii. p. 446, pl. 59. figs. 6, 7 (1867).

One much damaged example, Zomba.

It being generally decided that my name of *C. jocaste* has no claim to recognition, I yield the point rather than show myself eccentric; so long as all are agreed, it matters little what name a species is known by.

19. CHARAXES CITHÆRON.

Charaxes cithæron, Felder, Wien. ent. Monatschr. iii. p. 308, pl. 8. figs. 2, 3 (1859).

♂ ♀, Zomba.

20. CHARAXES BOHEMANI.

Charaxes bohemani, Felder, Wien. ent. Monatschr. iii. p. 321, pl. 6. fig. 3 (1859).

♂ ♂, Zomba.

One of the specimens obtained by Mr. McClounie at Zomba is of interest, inasmuch as on the upper surface it is distinctly blue, instead of green shading into blue; the outline of the basal blue area on the primaries is also irregular, a large quadrate black patch, bounded externally by three blue spots, filling the end of the cell; underneath, the ground-colour is decidedly more rufous than usual. These differences are clearly individual.

21. CHARAXES VARANES.

Papilio varanes, Cramer, Pap. Exot. ii. pl. clx. figs. D, E (1779).

♂ ♂, Zomba.

22. EURALIA WAHLBERGI.

Diadema wahlbergi, Wallengren, Kongl. Sv. Vet.-Akad. Handl., Lep. Rhop. Caffr. p. 27 (1857).

Euralia anthedon, var. *marginalis*, Butler, Ann. & Mag. Nat. Hist. ser. 4, vol. xvi. p. 395 (1875).

♀, Zomba.

23. EURALIA MIMA.

Diadema mima, Trimen, Trans. Linn. Soc. xxvi. p. 506 note, pl. xliii. fig. 7 (1869).

Two females, Zomba.

Both sexes of this fine *Euralia* are in the *Hypolimnas* group of the Godman and Salvin collection recently added to the Museum series. The species is a good copy of *Amauris whytei*, the Nyasa representative of *A. albimaculata*, which it doubtless mimics in Natal, as Mr. Trimen observes.

24. JUNONIA ARTAXIA.

Junonia artaxia, Hewitson, Exot. Butt. iii. *Jun.* pl. i. fig. 6 (1864).

♀, Zomba.

25. JUNONIA PAVONINA, sp. n. (Plate XVI. figs. 1–3.)

Allied to *J. artaxia*. Primaries above having the same general aspect, but brilliantly glossed all over with peacock-blue; the broad black patch from costa only represented by a diffused dark shade, with sinuous external edge, beyond end of discoidal cell; the subapical whitish bar of *J. artaxia* represented by an angulated blue band enclosing an oblique trifid snow-white streak near the costa; and halfway between this band and the end of the cell there are three or four transverse blue spots bounding the upper portion of the dark shade previously noted; a slightly irregular, but not sinuated black stripe separates the angular blue subapical band from a diffused blue marginal band which tapers along the edge of the black stripe at its upper extremity and along the margin at its lower extremity; fringe dull white, grey towards apex and external angle and traversed throughout by a dusky line flecked with black: secondaries brilliant peacock-blue in the male, and the centre of the wing to beyond the middle blue in the female; ocelli of nearly equal size, a little brighter in colouring than in *J. artaxia*; submarginal lines wider and blacker: body slightly darker. Under surface very dissimilar, olive-brown; the pattern of the primaries nearly as in *J. nachtigalii*, but only glossed with purple below the cell; the four transverse stripes sharply defined and whity-brown, slightly glossed with blue below the median vein; an apical costal cuneiform whitish patch, partly edged with diffused white spots towards costal margin; ocelli small, olivaceous grey, with yellowish iris flecked internally with red; submarginal line slender, blackish, irregularly undulated: secondaries somewhat paler and greyer, especially towards abdominal margin; a sharply defined, blackish-edged, central clear yellowish-white stripe from costa to anal angle; two other, less sharply defined stripes between the latter at the base from costa to submedian vein, where they unite in a loop, the inner stripe being straight and the outer obtusely elbowed; ocelli slightly larger than on the primaries, but similar in character, followed by a nebulous sinuated streak; submarginal line steel-bluish, diffused internally but defined externally by a whitish irregularly undulated stripe; fringes with whitish basal and dark brown central lines; palpi below whitish. Expanse of wings 73–75 millim.

Dry-season form ♀. Smaller; the angle of primaries less produced below apex; the secondaries with slightly larger and brighter ocelli; a small ocellus indicated on the first median interspace of the primaries: wings below olive-brown, the bands across the primaries lilac, but the apical patch whiter; three sharply defined ocelli coloured as on the upper surface—one small, on upper radial interspace, a second large on lower median interspace, and the third very small, below the second: secondaries with all the whitish markings ill-defined, but both ocelli clearly defined. Expanse of wings 66 millim.

Fwambo.

Four typical specimens and two females of the supposed dry-season form were obtained. It is, without question, by far the most beautiful *Junonia* hitherto discovered.

Whilst deprecating the positive way in which Lepidopterists have, of late years, decided (without breeding in most instances) respecting the seasonal forms of Butterflies, I do not for a moment pretend to say that their conclusions are unlikely, in most instances, to prove correct. In the present case the two forms of female, though very different in aspect, are so evidently only modifications of the same species that it is but reasonable to conjecture that the smaller form with prominent ocelli is that of the dry-season.

26. JUNONIA NACHTIGALII.

Precis nachtigalii, Dewitz, Nova Acta Akad. Naturf. Halle, 1879, p. 194, pl. i. fig. 16.

Fwambo.

One example of this rare species. Is it the dry-season form of *J. artaxia*?

27. JUNONIA SESAMUS.

Precis sesamus, Trimen, South Afr. Butt. i. p. 231, pl. iv. fig. 3 (1887).

Zomba.

28. JUNONIA ACTIA.

Precis actia, Distant, P. Z. S. 1880, p. 185, pl. xix. fig. 7.

One male, Zomba.

29. JUNONIA ARCHESIA.

Papilio archesia, Cramer, Pap. Exot. iii. pl. ccxix. figs. D, E (1782).

♀, Zomba; ♂ ♂, Fwambo.

The whole of the specimens are very dark, larger than usual, and with the red ocellated belt narrower and slightly darker than in the majority of specimens; the under-surface colouring varies individually to an enormous extent, two examples exactly represent the *Precis staudingeri* of Dewitz, which is thus seen to be only one of the sports of *J. archesia.*

30. JUNONIA CHAPUNGA.

Junonia chapunga, Hewitson, Exot. Butt. iii. *Jun.* pl. i. figs. 2, 3 (1864).

♀, Zomba.

The pale ocelloid band strongly developed, nearly approaching some specimens of *J. pelasgis.*

31. JUNONIA CUAMA.

Junonia cuama, Hewitson, Exot. Butt. iii. *Jun.* pl. i. figs. 4, 5 (1864).

One damaged male, Zomba.

32. JUNONIA NATALICA.

Precis natalica, Felder, Wien. ent. Monatschr. iv. p. 106 (1860).

One specimen, Zomba.

33. JUNONIA BÖOPIS.

Junonia böopis, Trimen, Trans. Ent. Soc. London, 1879, p. 331.

Zomba.

34. JUNONIA CLELIA.

Papilio clelia, Cramer, Pap. Exot. i. pl. xxi. figs. E, F (1779).

Zomba.

A specimen with narrow white fascia beyond the cell as in *J. epiclelia.*

35. PYRAMEIS CARDUI.

Papilio cardui, Linneus, Faun. Suec. p. 276. no. 1054 (1761).

♂, Zomba.

METACRENIS, sp. n.

Harma (part), Hopffer in Peters's Reise n. Mossambique, v. p. 391. (Type, *H. concordia,* Hopff.)

H. concordia and its allies have hitherto been regarded as belonging to the genus *Crenis*; to which, however, they bear but a slight resemblance: their more rounded primaries, pattern, and robust habit are far more characteristic of *Argynnis* or *Atella*; but their nearest allies seem to be the species of the genera *Hamanumida* and *Diestogyna,* from which, however, the stouter and more erect palpi of the type species would at once separate it if the very dissimilar character of these organs in the allied *M. rosa* did not demonstrate the unreliability of such a distinction. It may, however, be differentiated from *Hamanumida* as follows:—Secondaries comparatively smaller and less produced at anal angle: discoidal cell of primaries shorter, upper discocellular not oblique, inarched; second and third median branches emitted nearer together, but with slight variations in the different species; lower discocellular of secondaries better defined. All other characters are inconstant, such as the relative position and length of furca of the subcostal branches of the primaries, the form of the præcostal veinlet of the secondaries, the stoutness of the antennæ, the length and uprightness of the palpi, and the robustness of the thorax; they serve only to distinguish the species.

From *Crenis*, apart from its totally different outline, broader wings, and utterly dissimilar style of coloration, *Metacrenis* differs in the longer and cylindrical club to the antennæ, the less strongly inarched discocellulars of the primaries, and the broader and less produced discoidal cell of secondaries. The position of the præcostal veinlet differs greatly in *M. crawshayi* and *M. rosa*—being emitted as in *Hamanumida* in the former, and as in *Crenis natalensis* in the latter: in fact, if all the structural characters were to be regarded as of generic value, these two evidently allied species would have to be widely sundered, the first being placed nearer to *Hamanumida*, the last to *Crenis*.

36. METACRENIS CRAWSHAYI.

♂. *Crenis crawshayi*, Butler, P. Z. S. 1893, p. 654, pl. lx. fig. 5.

♀. Approaches Hopffer's figure of his *M. concordia* (Peters's Reise, Zool. v. p. 391, pl. 22. figs. 3, 4, 1862), but the ground-colour above is bright rosy-lavender, with all the black spots much more elongated; the primaries show two little diffused white dashes instead of the oblique yellow bar of *M. concordia* and all the other yellow shades are wanting, but the nervures between the discal and submarginal series of spots have rufous-brownish borders and the spots themselves are connected by blue-grey streaks: below, the colouring is much brighter than in Hopffer's figure, the black spots are elongated; the first four discal spots of the primaries are connected by blue longitudinal streaks with the submarginal spots; there is no continuous blue border on any of the wings, but only small marginal blue spots as in my figure of the male. Expanse of wings 69 millim.

One female, Fwambo.

Hopffer's figures of *M. concordia*, if intended to represent this species, are so bad that it is no marvel that (with the book on my table) a cursory glance at the plate failed to save me from committing what my friend Trimen assures me is a grievous blunder. In the first place, Hopffer described his species as a *Harma* and in Kirby's 'Catalogue of Diurnal Lepidoptera' it remains in that genus under its emended title; so that, in looking up the known species of *Crenis*, I naturally did not have my attention particularly called to it. When Mr. Trimen, with his wide knowledge of African Butterflies, assured me that my species was a synonym of Hopffer's, I again looked at the figure and concluded that he was correct; but, with the female of *M. crawshayi* before me, I feel certain, when we see *M. concordia*, that we shall discover the illustration to be correct, and the butterfly differing from mine, as above noted[1]; that is to say, in some respects, more nearly related to *M. rosa*, which has the rounded black spots, disconnected blue spots, but continuous blue border of *M. concordia.* It is also most probable that the antennæ and palpi, as well as neuration, will be found intermediate between the two.

37. HAMANUMIDA DÆDALUS.

Papilio dædalus, Fabricius, Syst. Ent. p. 482. n. 174 (1775).
Zomba.

38. PSEUDARGYNNIS DUODECIMPUNCTATA.

Iaera duodecimpunctata, Snellen, Tijd. voor Ent. 2nd ser. part 7, pl. 1. figs. 1, 2 (1872).
♀, Zomba.

39. ATELLA COLUMBINA.

Papilio columbina, Cramer, Pap. Exot. iii. pl. ccxxxviii. figs. A, B, iv. pl. cccxxxvii. figs. D, E (1782).
Zomba.

40. NEPTIS AGATHA.

Papilio agatha, Cramer, Pap. Exot. iv. pl. cccxxviii. figs. A, B (1782).
Zomba.

41. ACRÆA CABIRA.

Acræa cabira, Hopffer, Ber. Verh. Akad. Berlin, 1855, p. 640; Peters's Reise n. Mossamb. p. 378, pl. 23. figs. 14, 15 (1862).
Zomba.

42. ACRÆA EXCELSIOR.

♂. *Acræa excelsior*, E. M. Sharpe, P. Z. S. 1891, p. 192, pl. xvii. fig. 3.
♂ ♀, Fwambo.

43. ACRÆA VENTURA.

Acræa ventura, Hewitson, Ent. Mo. Mag. xiv. p. 51 (1877).
♂ ♂, Fwambo.

44. ACRÆA ACRITA, var.

Acræa acrita, Hewitson, Exot. Butt. iii. *Acr.* pl. 3. fig. 18 (1865).
♂, Fwambo.

A most interesting specimen, exactly halfway between typical

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[1] Hopffer says, "Mit einer graublauen Randeinfassung," and, later on, "eine Reihe schwarzer, rundlicher Fleckchen": his locality is Querimba, Mozambique.

A. acrita and *A. pudorina*, Staud.: the latter therefore can only be regarded as an imperfectly isolated race of *A. acrita.*

45. Acræa, sp. inc.

A somewhat melanistic female specimen, having the primaries very like *A. acrita* on both surfaces; but the pattern and coloration of the under surface of the secondaries curiously like *A. anacreon*, with the central rosy band well developed. It would be rash to describe it on this single example, without carefully studying the whole of the species, as it may prove to be an aberrant example of some described species; but, so far, I have failed to identify it. At first I supposed it to be the female of M. Oberthür's *A. chœribula*, but a careful comparison with the male of that species proves clearly that it is distinct.

Fwambo.

46. Acræa natalica.

Acræa natalica, Boisduval, Voy. de Deleg. p. 590 (1847).

♂, Zomba.

47. Acræa areca.

Acræa areca, Mabille, Bull. Soc. Ent. France, 1888, p. clxix; Nov. Lep. p. 100, pl. xiv. fig. 5 (1893).

♂ ♂, Zomba.

48. Alæna aurantiaca, sp. n. (Plate XV. fig. 4.)

Bright orange above; the cell of primaries black, leaving a triangular subbasal spot and a quadrate subterminal spot of orange; costal border black, with a fine basal orange streak; base, nervures, one or two spots near the base below origin of first median branch and internal border black; external border rather more broadly black, widest at apex, its inner edge sinuated between the nervures; base of the secondaries occupied by a broad irregular black blotch; a black spot on upper discocellular; veins partly black, outer border broadly black: body black; collar tufted at the sides with orange; abdomen orange at the sides. Under surface with the black slightly more restricted than above, the costa of primaries streaked with ochreous, the outer border interrupted by two rows of cream-coloured spots, the inner row irregular, abbreviated, consisting of five oval spots, the outer regular, of seven: secondaries—the basal black patch interrupted by two rows of creamy spots, the inner consisting of four, the outer of two spots; external border enclosing two series of eight creamy-white spots: body black, legs and sides of abdomen orange. Expanse of wings 34 millim.

Two examples (one much damaged), Fwambo.

In the pattern of the upper surface this pretty little species is nearest to *A. amazoula*, but the under surface more nearly approaches *A. interposita.*

49. Axiocerces amanga.

Zeritis amanga, Westwood, in Oates's 'Matabele-Land,' p. 351 (1881).

♂, Fwambo.

50. Mylothris agathina.

Papilio agathina, Cramer, Pap. Exot. iii. pl. ccxxxvii. figs. D, E (1782).

Two females, Zomba.

51. Terias chalcomiæta.

Terias chalcomiæta, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. iii. p. 190 (1879).

Two males, Zomba.

52. Teracolus epigone.

Teracolus epigone, Felder, Reise der Nov. Lep. ii. p. 186.

♂, Zomba.

53. Catopsilia pyrene.

Colias pyrene, Swainson, Zool. Ill. i. pl. 51 (1820–21).

♂, Zomba.

54. Belenois mesentina.

Papilio mesentina, Cramer, Pap. Exot. iii. pl. cclxx. figs. A, B (1782).

Two males of the var. *lordaca*, Zomba.

55. Papilio corinneus.

Papilio corinneus, Bertoloni, Mem. Acc. Bologna, 1849, p. 9, pl. 1. figs. 1–4.

Zomba.

56. Papilio nivinox. (Plate XVI. fig. 4.)

Papilio nivinox, Butler, P. Z. S. 1893, p. 667.

Two males, Fwambo.

This species differs from the allied *P. taboranus* of M. Oberthür in its superior size; the larger white spots on the subapical area of the primaries; the larger postmedial spots, which form an oblique band; in the white spots of secondaries forming a complete broad belt over the basal two-thirds; in the small discal spots on these wings; in the inner discal series of under surface consisting of three spots and bounded internally by ochreous clay-colour, in the much larger spots of the outer series; in the confluence of the crimson and yellow on the internal area and the darker submarginal band.

57. PAPILIO OPHIDICEPHALUS.

Papilio ophidicephalus, Oberthür, Études, iii. p. 13 (1878).

♀, Zomba.

58. TAGIADES FLESUS.

Hesperia flesus, Fabricius, Spec. Ins. ii. p. 135 (1781).

♂, Zomba.

One curious example, in which the hyaline spots on the primaries have either disappeared or been greatly reduced in size.

59. SAPÆA TRIMENI, sp. n. (Plate XV. fig. 5.)

Abantis zambezina, Trimen (not Westwood), Smith, Afr. Butt. iii. p. 344, footnote.

Neither the figure nor the description of Westwood's insect correspond with this species, nor is there the slightest reason for Mr. Trimen's supposition that the sides of the abdomen had "probably become discoloured." The following comparison will, I think, show that this view of the case will not account for the differences between the two types:—

Oxynetra zambesiaca, Westwood (not *Abantis zambezina*).

"The fore wings are chalybeous black.

"The head and body are black, the head with a large white frontal spot, and two small ones between the eyes. The tippets of the collar or prothorax are clothed with scarlet hairs, the tegulæ or wing-scales, together with a pair of dots in front of them, and a second pair behind them at the sides of the disc, as well as the narrow hind margin of the scutellum, white: the latter is followed by a curved band of scarlet, the extremity of the abdomen being of the same colour: the four middle segments of the abdomen are luteous, with a narrow dark longitudinal line down the centre."

Sapæa trimeni, Butler (*Abantis zambezina*, Trimen).

The fore wings are peacock-green, black in the centre; the hyaline spots rather smaller than in Westwood's species, and there is usually a small extra one on interno-median area.

The hind wings have the external area almost wholly metallic Prussian blue (not chalybeous black).

The palpi are almost wholly snow-white, like the frontal patch; there is a central transverse white line on the vertex, as well as the two dots at the base of the antennæ; the pterygodes are purplish black at base, with a large patch of white before the terminal fringe, which is dull black; there is also a double white spot at the base of the front wings.

As with Westwood's species there are two convergent tufts of carmine hairs, forming what he calls "a curved band of scarlet" at the back of the thorax, and the abdomen terminates in a tuft of the same colour, but here the resemblance ceases: the upper surface is blue-black, with a broad quadrate snow-white patch occupying three (not four) segments on each side and separated by a broad black dorsal stripe; looking at the insect in profile this patch is seen to be united by a stripe of white to a narrower white patch on the basal segment; the venter, again, is snow-white down the centre, but purplish black at the sides; the front and middle coxal joints are clothed with carmine hair and the sides of the pectus with delicate long white hair; the tibial and tarsal joints are white.

Three specimens, Fwambo.

It is hardly probable that staining would convert three central and a basal snow-white segments of the abdomen into four central fulvous segments, or peacock-green into chalybeous black; but when it is noted that all the other white markings remain unchanged in Westwood's insect, the chance of change by staining becomes next to impossible. The Zambezi insect is probably nearer to *S. paradisea* than is *S. trimeni*: thus the fulvous segments are accounted for.

60. CYCLOPIDES MIDAS. (Plate XV. fig. 6.)

Cyclopides midas, Butler, P. Z. S. 1893, p. 671.

♂, Fwambo.

61. BAORIS INCONSPICUA.

Hesperia inconspicua, Bertoloni, Mem. Acc. Bol. 1849, p. 15.

Fwambo.

One starved example, with unusually brightly-coloured under surface.

62. CERATRICHIA PUNCTULATA, sp. n. (Plate XV. fig. 7.)

Above with the general aspect of *C. stellata* (*Cycl. mineni*, Trimen), black-brown: primaries with two superposed white dots in the cell, and a slightly irregular elbowed series of eight slightly larger white spots beyond the cell; fringe greyer than the wings, especially at the tips, and interrupted at its base by a series of elongated whitish spots: secondaries with five indistinct whitish dots in a zigzag series beyond the cell; fringe as in the primaries: abdomen black, edges of segments white laterally; antennæ with white rings, the club only ringed below; palpi greyish. Primaries below blackish, the costal border and apex yellowish olive-brown, traversed by whitish veins; the white spots arranged as above but larger, the elbowed series having an additional white point between the seventh and eighth spots; fringe blackish, with conspicuous elongated white spots and grey tips: secondaries yellowish olive-brown, with whitish veins; the white spots larger than above and seven additional spots, two bounding the middle third of the subcostal area, a small one in the cell behind the upper discocellular, and the other four in pairs bounding the middle third of interno-median area; an indistinct zigzag whitish submarginal line, also feebly indicated on the primaries; fringe as in primaries: legs brown, paler internally; venter whitish. Expanse of wings 30 millim.

A pair, Fwambo.

I have failed to discover any published description of this species.

63. HESPERIA ?, sp. ?

It is impossible to fix even the generic position of this species with certainty, as it has lost its palpi; but it appears to be allied to "*Proteides xychus*," Mabille, of which it may possibly be the male; the antennæ are white above.

♂, Fwambo.

HETEROCERA.

64. XANTHOSPILOPTERYX AFRICANA.

Eusemia africana, Butler, Ann. & Mag. Nat. Hist. ser. 4, vol. xv. p. 142 (1875).

Eusemia meretrix, Westwood in Oates's 'Matabele Land,' p. 355 (1881).

♀, Zomba.

Two somewhat worn specimens were obtained.

65. ANOMÆOTES NIGRIVENOSUS.

♀. *Anomœotes nigrivenosus*, Butler, P. Z. S. 1893, p. 676, pl. lx. fig. 10.

♂. Smaller than the female, creamy pale straw-yellow, with blackish veins and edges to the wings; thorax blackish brown; abdomen golden yellow, becoming tawny on the margins of the segments; pectus and legs brown, venter pale yellow; clasps ochraceous brown, shining. Expanse of wings 28 millim.

♂ ♀, Fwambo.

Two males and one female, the latter slightly longer in wing and with blacker thorax than the type; the front of the discoidal cell of the secondaries also projects slightly more prominently forward in this example; but slight variations of neuration may be expected to occur in this group of Moths.

66. ARGINA LEONINA (=A. AMANDA, var., Boisd.).

Deiopeia leonina, Walker, Cat. Lep. Het. xxxi. p. 262 (1864).

♂, Fwambo.

67. ARGINA OCELLINA.

Deiopeia ocellina, Walker, Cat. Lep. Het. ii. p. 571. n. 9 (1854).

♂, Fwambo.

The single example of this form has the ground-colour of the primaries white, thus bearing out the opinion which I have long held—that in Africa there is only one species of this genus, of which the synonymy would be as follows:—

ARGINA AMANDA.

Euchelia amanda, Boisduval, Voy. de Deleg. ii. p. 597 (1847).

Deiopeia cingulifera, Walker, Lep. Het. ii. p. 569 (1854).

Deiopeia ocellina, Walker, l. c. p. 571.

Deiopeia leonina, Walker, l. c. vol. xxxi. p. 262 (1864).

Deiopeia albocincta, Rambur, Cat. Lep. Andal. ii. p. 228, note (1866).

Deiopeia serrata, Mabille, Le Nat. i. (3) p. 5 (1879).

Africa generally and Madagascar.

In Madagascar and the Mascarene Islands the allied Indian species *A. cribraria* also occurs; the latter varies considerably and has received many names. *Lomaspilis pantheraria*, Felder, referred to *Argina* by Mr. Kirby, is most probably a Geometrid Moth.

PSEUDOSPIRIS, gen. nov.

General aspect of *Spiris*, but the male with simple antennæ, and the radial vein of the secondaries emitted from the middle of the discocellulars; subcostal vein of primaries 5-branched, the first branch emitted long before the end of the cell, the second at the end, the third, fourth, and fifth emitted from a long footstalk from end of cell, the upper radial is also emitted from the inferior margin of the same footstalk; in the secondaries the subcostal branches are emitted from a short footstalk; the frenum is very long in both sexes; the palpi are short, the antennæ thick and not unlike those of the *Agaristidæ*; a prominent black corneous frontal process. Type, *P. paidiformis*.

68. PSEUDOSPIRIS PAIDIFORMIS, sp. n. (Plate XV. figs. 8, 9.)

♂. Curiously like *Pais gordoni* both in pattern and colouring: primaries above pale buff, a black costal line running from the base to the basal fourth, from which point it thickens and leaves a narrow edging of the ground-colour to apex; a <-shaped subbasal line, the lower furca of which runs along the submedian vein, a dot near base of discoidal cell, a bisinuated undulated line across basal fourth to submedian vein, two annular markings forming an oblique 8-shaped character, an annular sigmoidal marking over end of cell, an oblique line, slightly zigzagged above the middle, at external third, a series of longitudinal internervular streaks to the outer margin, and the margin itself black; an irregular interrupted ferruginous-red band across the basal area between the two black lines; the inner border, excepting at base, and a band, of the same form as and immediately beyond the zigzagged discal black line, also ferruginous red, but the band edged on both sides with metallic silver scales: secondaries ferruginous red, with the apex, outer margin, and fringe blackish: thorax black, varied with whitish; abdomen ochreous, banded with blackish. Under surface of wings pale tawny ferruginous, with the costal borders yellower; a tapering external yellowish border intersected by black stripes from costa, in the primaries extending to external angle and bounded on the costa by a blackish spot, but in the secondaries terminating at the extremity of the first median branch, bounded internally by a dusky streak, which becomes paler towards its inferior extremity; a blackish bar on the discocellulars: pectus blackish, clothed with ochreous hair; sides of frontal process and palpi white; tibiæ striped longitudinally and tarsi barred with white; venter with whity-brown basal segment, otherwise ochraceous barred with black-brown. Expanse of wings 49 millim.

♀. Primaries of a clearer yellowish tint than in the male, and with silvery scales sprinkled over the subbasal red markings and within the black annular markings: secondaries ochreous; a black curved bar on the discocellulars; outer border black, enclosing six ochreous spots and suffused, near anal angle, with ferruginous. Under surface ochreous, the external border bounded by a black stripe throughout and divided into elongated spots by black nervures; primaries with three blackish nearly central patches, answering to the annular markings of the upper surface; secondaries with the discocellular bar as above, and two small black spots in the cell: body below black, spotted with cream-colour and ochreous. Expanse of wings 53 millim.

Fwambo.

One male and two females were obtained. The male most nearly resembles *Pais gordoni* when the wings are open; the female when they are closed, owing to the ochreous colouring of its secondaries.

69. GNOPHRIA (?) FURCIFASCIATA, sp. n. (Plate XVI. fig. 5.)

♀. Primaries above silvery cream-white; the costal margin, fringe of outer margin, an irregular stripe before the middle elbowed just above the submedian vein, and a sigmoidal stripe commencing near apex and terminating at outer third of inner margin, with an inner subsigmoidal fork from median vein to outer fifth of costal margin, jet-black: the secondaries clear bright straw-yellow: body ochreous, the abdomen barred with blackish. Primaries below smoky grey, the borders irregularly ochreous, interrupted on the costa towards apex by two transverse bars of the ground-colour, so as to leave a subapical quadrifid ochreous patch: secondaries ochreous or straw-yellow, with a tapering subapical bar from costa: body below ochreous; tarsi and venter barred with black. Expanse of wings 51 millim.

Fwambo.

Of this very striking species we only received one imperfect specimen wanting a head: doubtless it is not, strictly speaking, a *Gnophria*, but an allied new genus, the lower radial of the primaries being independently emitted from the inferior angle of the cell instead of from the third median branch; but in the secondaries the radial forms a very short furca with the extremity of the third median branch, the footstalk occupying about three-fourths of the distance between the cell and the margin; with only an imperfect female, however, it would be premature to propose a new genus for its reception.

70. ALPENUS ÆQUALIS, var.

Alpenus æqualis, Walker, Lep. Het. iii. p. 686 (1855).

Fwambo.

Eastern examples differ from the Western type in having the annular markings on the primaries filled in with black and partly confluent towards costa; in all probability a series collected right across Africa from west to east would exhibit every grade from one type to the other: it is also extremely probable that *A. æqualis* will prove to be quite inseparable from *A. maculosus* of Stoll, which only differs in its finer maculation.

71. PLERETES THELWALLI.

Hypercompa thelwalli, Druce, P. Z. S. 1882, p. 779, pl. 61. fig. 1.

Zomba.

One female was obtained.

72. LECHRIOLEPIS VARIA.

Amydona varia, Walker, Lep. Het. vi. p. 1414 (1855).

Fwambo.

A most brilliantly coloured species when in good condition.

73. LEBEDA VENOSA, sp. n. (Plate XVI. fig. 6.)

Primaries to beyond the middle greyish flesh-colour, beyond which they are darker brownish flesh-colour; the costa and all the veins deep ochreous; two ill-defined whitish stripes, the first transverse, straight, crossing the centre of the paler basal area, the other oblique, bounding the basal area beyond the middle; an ill-defined pale spot in the upper angle of the cell and an irregular discal series of whitish spots or lunules, with greyer external borders; fringe cream-coloured: secondaries brownish flesh-coloured, shading into ochraceous buff towards base and abdominal margin; veins and fringe as on the primaries: thorax pinky ochraceous, deeper at centre of collar and base of pterygodes; sides of collar greyish; antennæ greyish flesh-coloured, abdomen ochraceous buff. Wings below greyish flesh-coloured, with the veins, margins, and basal hairy clothing ochreous; body below ochreous. Expanse of wings, ♂ 81 millim., ♀ 70 millim.

Fwambo.

I had an idea that I had seen an illustration of this species, but finally discovered that Moeschler's *Philotherma jacchus* was the insect I was thinking of. The primaries of the latter are very similar, both in general coloration and pattern, to *L. venosa*, but the secondaries are entirely different both in form and coloration.

74. HIBRILDES NORAX.

Hibrildes norax, Druce, P. Z. S. 1887, p. 675.

♀, Fwambo.

One much-worn example was obtained.

75. TANOROPSIS FLAVINATA.

Dreata flavinata, Walker, Lep. Het. xxxii. p. 573 (1865).

♀, Fwambo.

A slightly aberrant example, though apparently hardly referable to a distinct species.

76. ANTHERÆA EMINI.

♀. *Antheræa emini*, Butler, P. Z. S. 1888, p. 84.

♂. Above very like *A. dione* ♂, but much larger and with considerably larger ocelli, that on the secondaries uniting the two transverse dusky bands as in the female, the outer band, as in that sex, more parallel to the outer margin than in *A. dione*; colouring below similar to that of *A. dione* ♀, but with the whitish areas better defined. Expanse of wings 144 millim.

♂, Fwambo.

77. ANTHERÆA ? ZADDACHII.

Saturnia zaddachii, Dewitz, Mitth. Münch. ent. Ver. iii. p. 34, pl. ii. fig. 6 (1879).

♂ ♀, Fwambo.

I believe this and the preceding species would be more correctly referred to *Bunæa*.

78. BUNÆA NICTITANS.

Bunæa nictitans, Maassen & Weym. Beitr. z. Schmetterlingskunde, fig. 53.

Fwambo.

One example only. The species is evidently allied to the preceding and to *Antheræa belina*.

79. CYLIGRAMMA LATONA.

Phalæna (*Noctua*) *latona*, Cramer, Pap. Exot. i. p. 20, pl. xiii. fig. B (1779).

Zomba.

80. CALLIODES GLAUCESCENS.

Calliodes glaucescens, Butler, P. Z. S. 1893, p. 680. n. 187.

Two females, Fwambo.

DESCRIPTION OF THE PLATES.

PLATE XV.

Fig. 1. *Charaxes macclounii* ♂, p. 252.
2. „ *leoninus* ♂, p. 253.
3. „ *whytei* ♀, p. 255.
4. *Alæna aurantiaca*, p. 262.
5. *Sapæa trimeni*, p. 264.
6. *Cyclopides midas*, p. 265.
7. *Ceratrichia punctulata*, p. 265.
8, 9. *Pseudospiris paidiformis*, p. 267.

PLATE XVI.

Figs. 1, 2. *Junonia pavonina* ♂, p. 257.
Fig. 3. „ „ dry-season form.
4. *Papilio nivinox*, p. 263.
5. *Gnophria furcifasciata*, p. 268.
6. *Lebeda venosa* ♀, p. 269.

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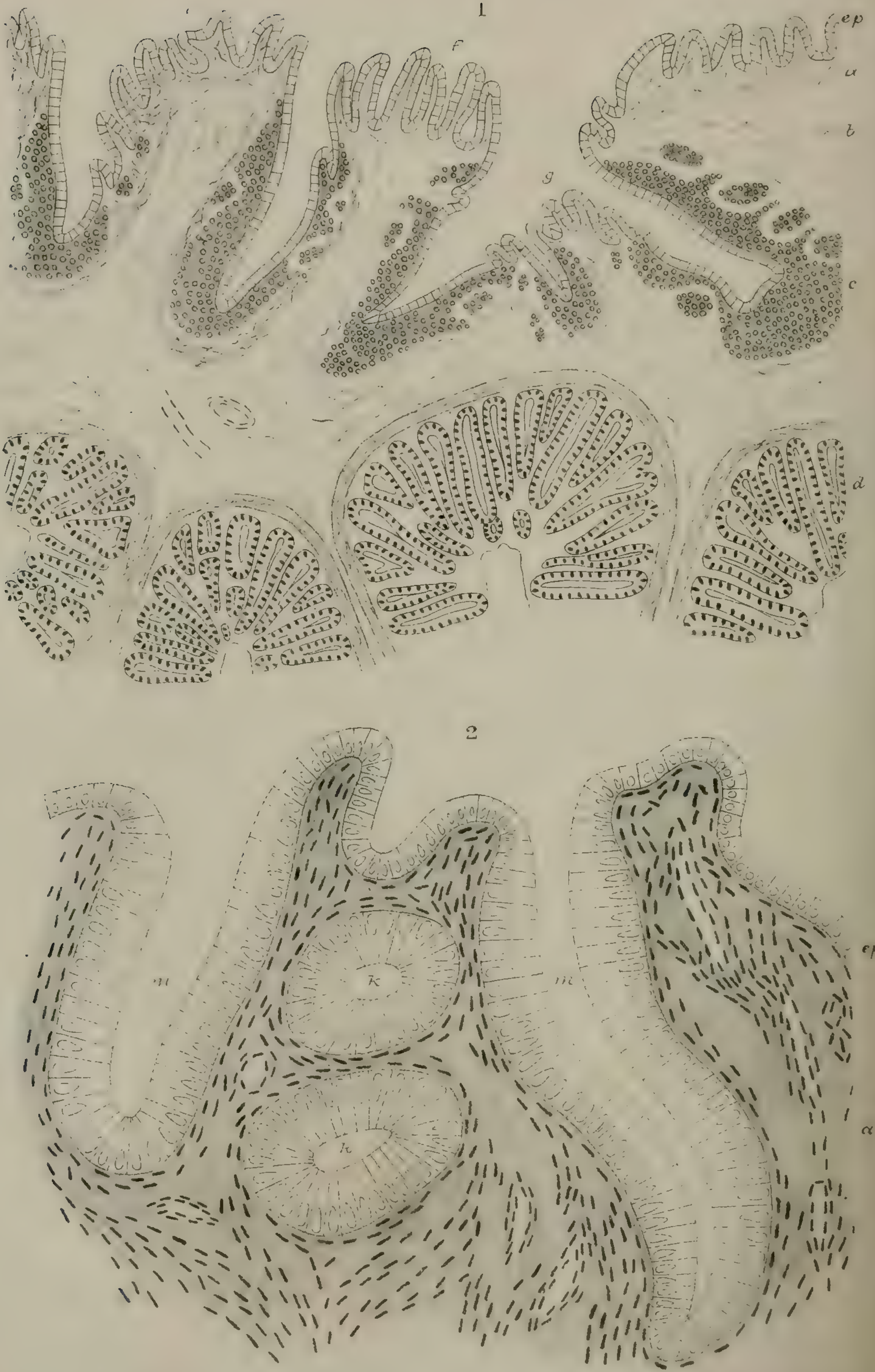
P.Z.S. 1895. Plate XVII.



P.C.M. ad nat. del.
M.P. Parker lith.

West, Newman imp.

Proventricular crypts of Pseudotantalus ibis.

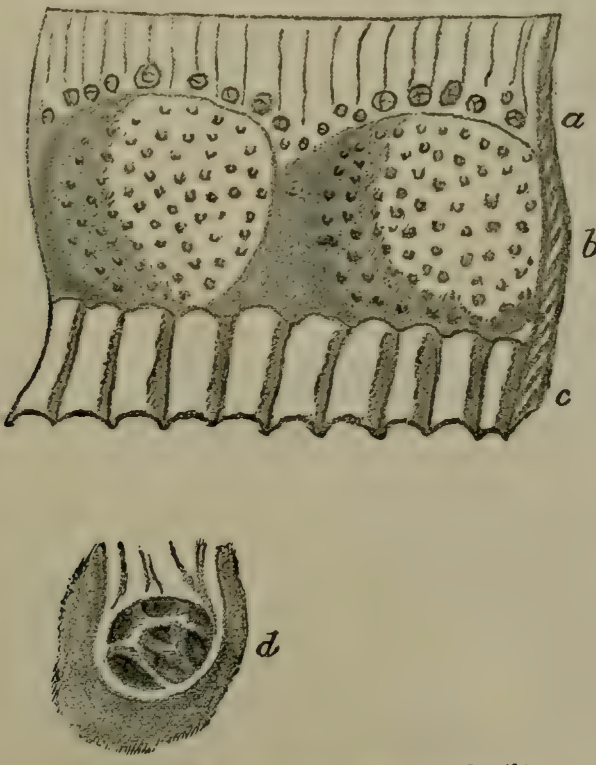
5. On the Proventricular Crypts of *Pseudotantalus ibis*.

By P. Chalmers Mitchell, M.A., F.Z.S.

[Received March 19, 1895.]

(Plate XVII.)

While dissecting a specimen of *Pseudotantalus ibis*, the African Tantalus, kindly placed at my disposal by the Society's Prosector, I found a set of peculiar structures in the proventriculus which were new to me and of which I could find no description. The general shape of the stomach is similar to that of *Leptoptilus crumeniferus* and *L. argala* and of *Carphibis spinicollis*. The gizzard is capacious and thin-walled, although tendinous in certain areas. The proventriculus is narrower than the gizzard. Upon opening it one sees that the horny lining of the gizzard ends abruptly in the proventriculus, the internal surface of the latter being smooth. In the four birds mentioned, the proventricular glands are not scattered all over the surface of the proventriculus, but are arranged over two very well-defined and nearly circular areas. The inner surface of these areas is studded with the large



Proventricular Crypts of *Pseudotantalus ibis*.

The upper figure represents the proventriculus and a small portion of the gizzard laid open. *a* is placed opposite the row of crypts, *b* opposite the glandular areas, *c* opposite the beginning of the gizzard, lined by the corrugated secreted membrane. *d* is an enlarged view of a single crypt.

and conspicuous apertures of the glands, and the two circular areas form thick pads that may be seen and felt from the outside before the stomach is opened. The figure in the text (p. 271) represents the proventriculus laid open, with the two circular areas conspicuous opposite the reference letter *b*. Above these, in the African Tantalus, is a single irregular row of pits, of different sizes and about twenty in number. In the figure the row is shown opposite the reference letter *a*, and at *d* an enlarged view of one of them is given. There is no trace of these pits or crypts in the other birds with similar proventriculus that I have examined. Each crypt is a shallow circular or oval pit, the margin of which is slightly elevated. From the floor of the crypt rise a system of crescentic folds of different sizes.

As the bird was tolerably fresh when I examined its intestine, I prepared microscopic sections through one of the crypts. The drawing (Plate XVII. fig. 1) represents one of these seen under a low power. *e*, *f*, and *g* are placed opposite the ends of the crescentic folds, the letter *g* being placed within the cavity of the crypt. The surface of these folds is set thickly with a number of small villi, and these are continued over the raised margin of the wall of the crypt. Fig. 2 represents some of these villi seen under higher magnification.

The whole of the pit is lined by an epithelium continuous with that lining the general surface of the proventriculus (fig. 1, *ep*, fig. 2, *ep*, *k* & *m*). Over the general surface this is an ordinary columnar epithelium, but here and there between the villi, as at *m*, it becomes glandular. At fig. 2, *k*, two of these glandular infoldings are seen in cross-section. Immediately under the epithelium seen at *a*, in fig. 1, and forming the solid mass in fig. 2, is a dense connective-tissue layer. This contains fibres and cells, and here and there capillaries and absorbents. This layer forms the greater part of the villi and lies next to the epithelium on the summits of the crescentic folds. But further down, in the cavity of the crypt, masses of lymphatic tissue (fig. 1, *c*) lie between the connective tissue and the epithelium. Here and there bands of connective tissue invade the masses of lymphatic cells and separate islands of them from the main mass. This layer of lymphatic tissue was the most conspicuous part of the sections, and as in some of them the epithelium had been destroyed it closely resembled a granular cuticular layer.

Under the connective-tissue layer was a thicker layer consisting of a loose stroma containing fibres, connective-tissue cells, and blood-vessels.

The deeper part of the section (fig. 1) passed through some of the follicles of the proventricular glands. Each of these was surrounded in the ordinary way by a capsule of connective tissue. I confess that I am unable to form any clear conception as to the function of these crypts. It is possible that they may serve for the absorption of water or of fluids. From the position of the stomach in the body, these crypts must lie very little above the level of the pylorus, and when the pyloric valve is closed and the gizzard filled with masses of food in process of digestion, any water swallowed could easily be absorbed by the crypts. Moreover the unusually large pyloric glands must require an abundant supply of water. However, this suggestion is of the most vaguely theoretical kind.

EXPLANATION OF PLATE XVII.

Fig. 1. Cross section through a single crypt (low power). *ep.* Epithelium. *a.* Dense connective-tisue layer. *b.* Connective-tissue stroma with blood-vessels. *c.* Lymphatic tissue. *d.* Proventricular glands. *e, f, g.* Crescentic folds of the crypt in cross-section.

Fig. 2. Enlarged view of part of surface of one of the crescentic folds in section. *ep.* Epithelium, becoming glandular at *m.* *k.* Glandular infolding of the epithelium in cross-section. *a.* Connective-tissue layer.

April 2, 1895.

W. T. Blanford, Esq., F.R.S., Vice-President, in the Chair.

The Acting Secretary read the following report on the additions to the Society's Menagerie during the month of March 1895:—

The registered additions to the Society's Menagerie during the month of March were 83 in number. Of these 50 were acquired by presentation, 20 by purchase, 4 were born in the Gardens, and 9 were received on deposit. The total number of departures during the same period, by death and removals, was 109.

Amongst these special attention was called to a Brazilian Three-banded Armadillo (*Tolypeutes tricinctus*), obtained by purchase March 29.

The Acting Secretary, Mr. Howard Saunders, exhibited on behalf of Lord Lilford a specimen of the American Wigeon (*Mareca americana*), lately obtained by Sir Ralph Payne-Gallwey, Bart. The bird, which proved on dissection to be a female, was found hanging up in the shop of a Mr. Murray, game-dealer at Leeds, with a lot of Common Wigeon, and had every appearance of having been freshly killed. This was the only existing authenticated specimen obtained in England since Mr. Bartlett purchased in the London market, in the winter of 1837–38, the example now in the collection of Mr. J. H. Gurney, of Keswick Hall, Norwich. Mr. Saunders called attention to the fact that a specimen, shot at Crotoy, mouth of the Somme, N. France, in April 1875, is or was in the collection of M. Marmottan, of Paris.

Mr. Boulenger exhibited specimens of two recently discovered Chameleons from Usambara, German East Africa, which had been sent to the British Museum by Dr. F. Werner, viz. *Chamæleon fischeri*, Reichenow, and *Ch. spinosus*, Matschie. Special interest attached to these species from the fact that they appeared to be more nearly related to the Madagascar species *Ch. bifidus* and *Ch. nasutus* than to any of the numerous forms previously known from Continental Africa.

The following papers were read:—

1. On the Sensory Canal System of Fishes. *Teleostei*—Suborder A. *Physostomi*.

By Walter Edward Collinge, F.Z.S., Assistant Lecturer and Demonstrator in Zoology and Comparative Anatomy, Mason College, Birmingham.

[Received March 11, 1895.]

(Plates XVIII.–XXI.)

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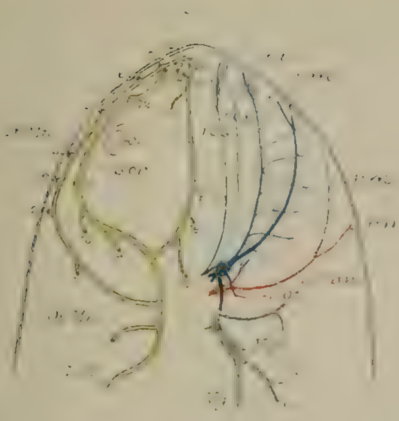
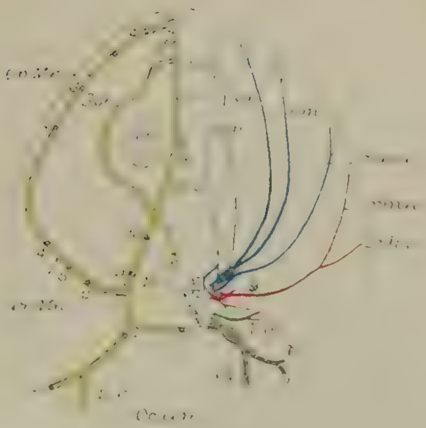
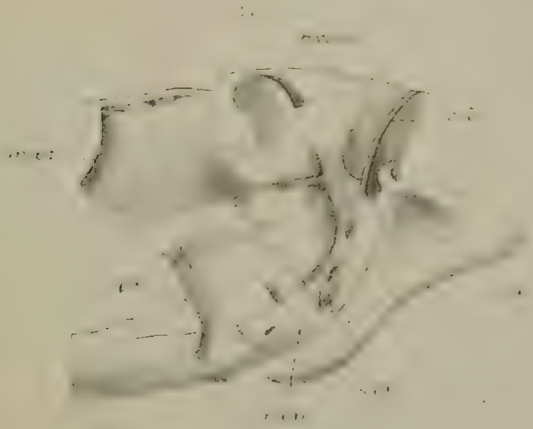
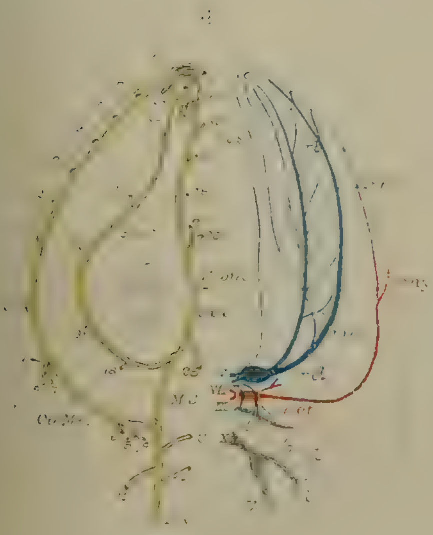
I. INTRODUCTORY.

The system of sensory canals in the Teleostean fishes exhibits so many features of interest both as regards the morphology and histology, and the relations of the cranial nerves to the canals, that it will not be possible to here treat of more than a single suborder, viz. the Physostomi. The system has been carefully worked out in a number of genera and the most interesting species









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West, Newman imp.

Sensory Canal System of Fishes.

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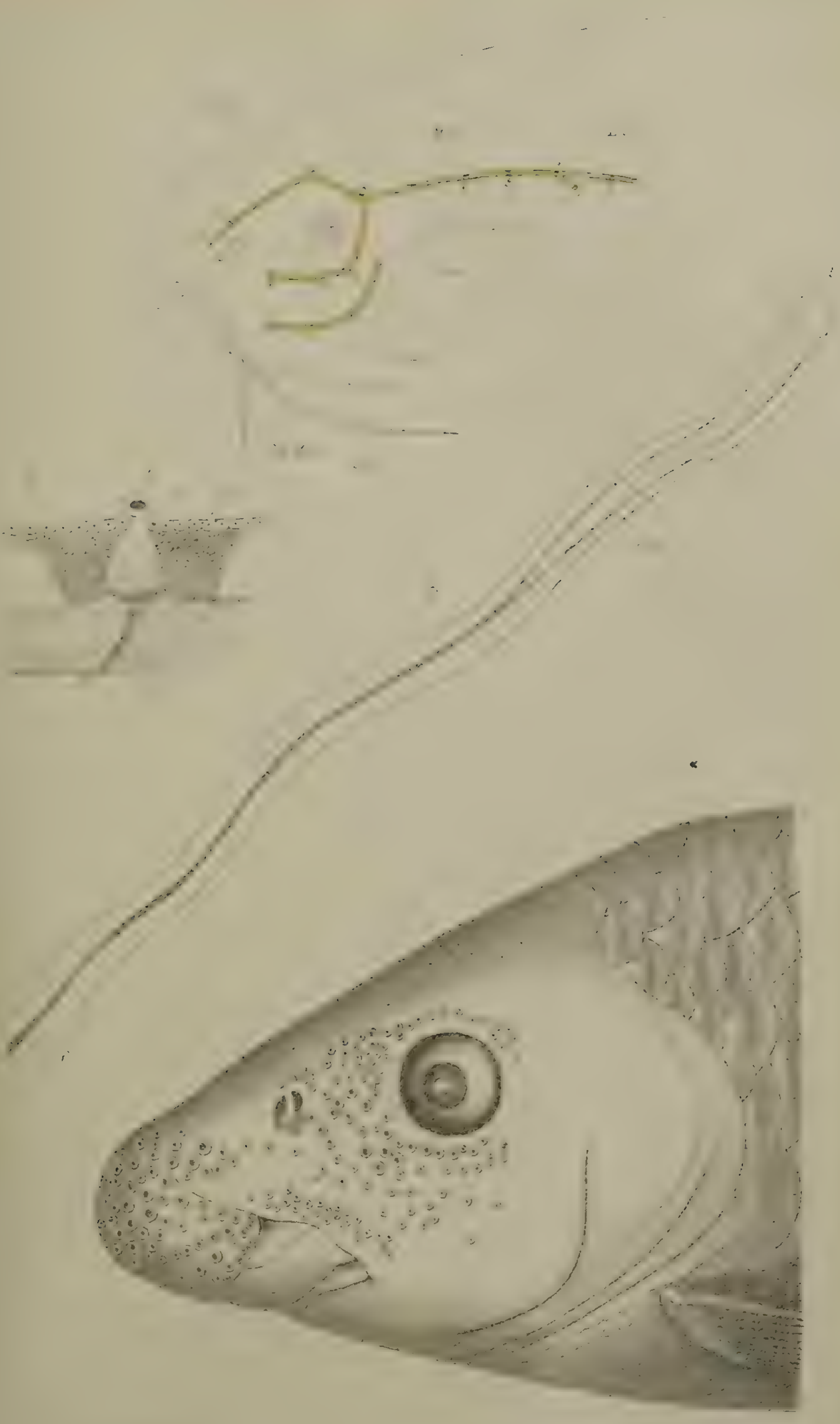
P. Z. S. 1895 Plate XIX.



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Sensory Canal System of Fishes.

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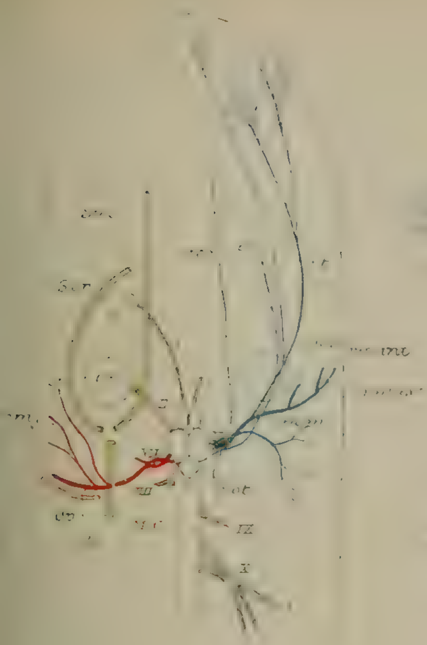

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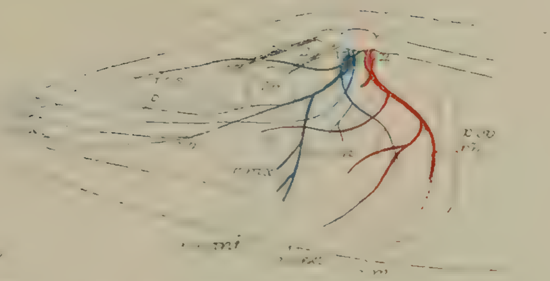

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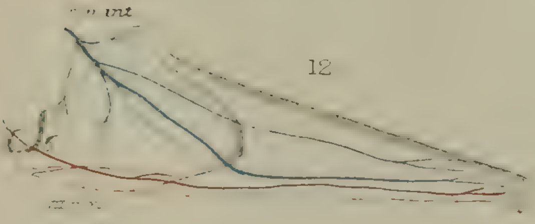

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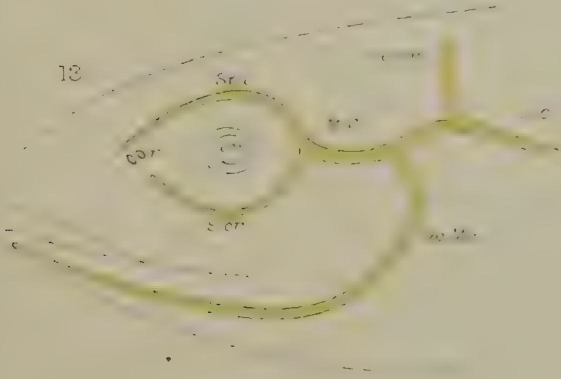

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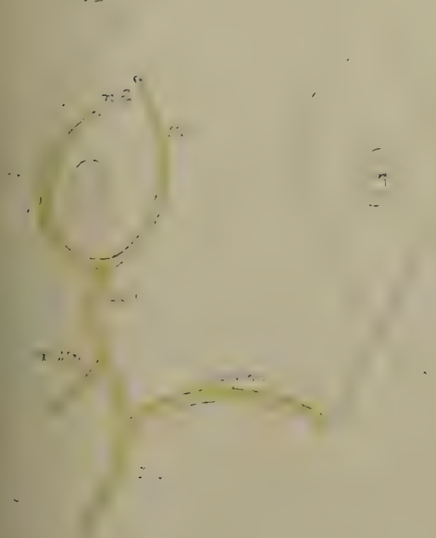

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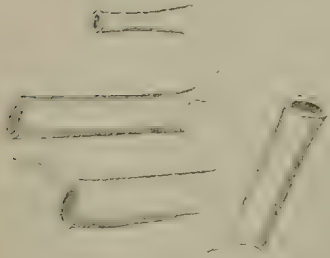

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Sensory Canal System of Fishes.

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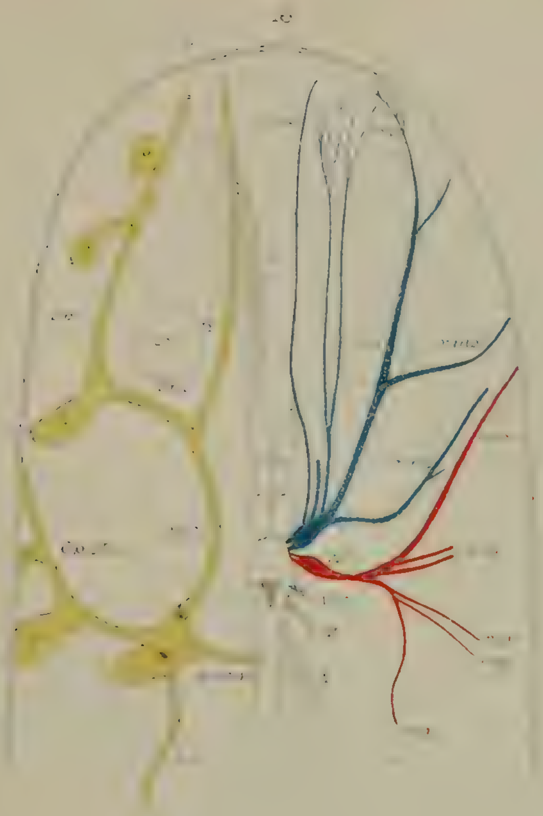

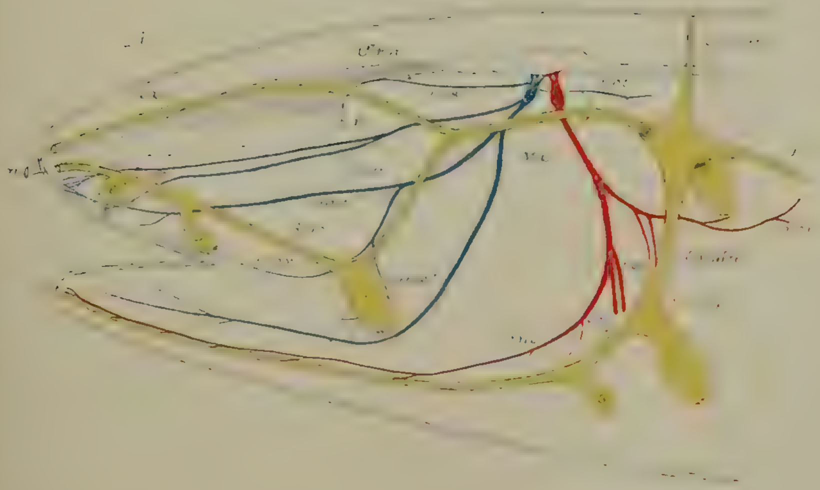

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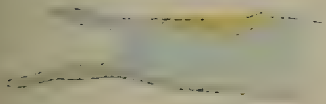

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M.P.Parker chromo.

West, Newman imp.

Sensory Canal System of Fishes.

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are described in detail. In all, the system is described in four families, viz. the *Siluridæ*, *Esocidæ*, *Salmonidæ*, and *Murænidæ*, which include eight different species referable to seven genera.

To Professor T. W. Bridge, M.A., of Mason College, Birmingham, I wish to offer my sincere thanks for the specimens of *Clarias*, *Callichthys*, and *Pimelodus*, and for the very generous and continued assistance which he has given me; also to Professor W. C. M'Intosh, M.D., F.R.S., for his kindness in granting me the use of a table at the St. Andrews Marine Zoological Laboratory, during the Long Vacation of 1893. My thanks are also due to Dr. Günther, F.R.S., who has identified for me the specimens of *Pimelodus* and *Labeo*.

II. SILURIDÆ.

The sensory canal system of certain genera of this family has been previously described by Ramsay Wright (12) and Pollard (11). The former has given a brief account of the canal system in *Amiurus catus* and a more detailed account of the cranial nerves. Pollard has described and figured the system and its innervation in *Clarias*, *Callichthys paleatus*, *Auchenaspis biscutatus*, *Trichomycterus tenuis*, and *Chætostomus guairensis*. Except in *Clarias*, he interpreted both the distribution of the sensory canal system and cranial nerves from a series of young specimens cut into sections. Although the cranial nerves of the *Siluridæ* are somewhat difficult to follow, I have preferred dissection as a means of investigation, and it will be noticed on comparing the figures of this author with those here given that there are many points of difference.

The canal system has been worked out in *Clarias nieuhofii*, *Amiurus catus*, *Pimelodus maculatus*, and *Callichthys littoralis*. The cranial nerves in *Clarias magur*, *Amiurus catus*, and *Pimelodus maculatus*.

1. CLARIAS NIEUHOFII[1].

General Description.

The sensory canal system commences as an exceedingly fine canal slightly in front of the base of the caudal fin. As it passes forwards its diameter increases. There are a series of pores opening into the canal, distributed at somewhat regular intervals. The canal traverses the region of the post-temporal and into the squamosal, from which point it may be regarded as the main canal of the head. It gives off a short backwardly directed branch, and immediately in front of this the operculo-mandibular branch arises (Pl. XVIII. fig. 1, *Op.Mn.*). From the squamosal the main canal continues along the dorsal border of the sphenotic, and divides into supra- and sub-orbital branches (Pl. XVIII. fig. 1): the former passing through the frontal and lateral ethmoid (*Parker*) and giving off in its course three smaller branches and a commissure in the frontal region; it continues through the nasal and terminates in the premaxilla. The sub-orbital branch passes through the anterior border of the sphenotic and into the post-orbital, in which it gives off a short branch and passes into the sub-orbital, giving off another branch and also opening by a pore. It continues forwards in the pre-orbital, in which in the suture with the nasal there is another pore; it then passes through the nasal bone and terminates in a bifurcation in the maxilla.

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[1] The specimen upon which all measurements, &c., were made was 360 millim. long.

Course of the Canals and Branches.

1. The Lateral Canal is an exceedingly fine dermal canal, scarcely visible to the naked eye in the posterior portion of the body. In the anterior region its diameter increases slightly; in no portion, however, was it found in transverse diameter to exceed ·6 of a millimetre.

It commences at a small pore 5 millim. in front of the base of the rays of the caudal fin. This terminal portion of the canal is directed somewhat dorsally, and therefore shares in the upward flexure of the terminal part of the vertebral column, as in the tail of *Polyodon.* It continues forwards along the side of the body, rising upon the post-temporal region. Distributed along its whole length are a series of pores, which are largest and most plentiful in the anterior region.

2. The Main Canal of the head commences in the squamosal. At its commencement it gives off a lateral and backwardly directed branch (Pl. XVIII. fig. 1) which ends blindly, a feature common to very many of the Physostomi. In front of this branch the operculo-mandibular branch arises. The main canal then continues forwards, passing through the dorsal border of the sphenotic. Its course is not perfectly straight, as in many fishes, but has a slight lateral inclination. In the most anterior portion of the sphenotic the canal divides into supra- and sub-orbital branches.

The Supra-orbital Branch.—Leaving the main canal on the anterior border of the sphenotic this branch passes forwards and inwards in the frontal. At its commencement it gives off on its inner side a backwardly directed branch, which passes into the squamosal and terminates at pore 15 (fig. 1). In front of this branch a much smaller one (pore 16) passes off and opens on the dorsal surface of the head. Slightly in front of this, and about the centre of the frontal bone, a branch (fig. 1, *f.com.*) is given off which meets with its fellow of the opposite side, thus forming a frontal commissure and connecting the supra-orbital branches of either side. A similar commissure is present in *Chætostomus.* From this commissure the canal continues through the frontal and lateral ethmoid, in the latter giving off a lateral and backwardly directed branch terminating at pore 17 (fig. 1), and passes into the nasal, here also branching laterally. The main branch passes forwards into the premaxillæ, on the lateral border of which it terminates at pore 19.

The Sub-orbital Branch passes down the anterior border of the sphenotic and through the post-orbital. At the commencement of its course in the post-orbital it gives off the backwardly directed branch terminating at pore 9. Continuing forwards it gives off another similar branch in the sub-orbital bone, which terminates at pore 10. It passes then into the lachrymal, opening by a pore on the suture, and then into the maxilla, where it bifurcates and terminates by the two pores 13 and 14 (fig. 1).

The Operculo-mandibular Branch leaves the main canal of the head in the anterior portion of the squamosal, from which it passes into and through the pre- and inter-operculum; in the former it branches, and opens in the latter by pore 2. Leaving the inter-operculum it becomes connected with the mandible by a fine dermal canal. It traverses the whole length of the mandible and in the most anterior portion meets with its fellow of the opposite side. In its course from the main canal of the head to the symphysis of the mandible it opens by eight pores. In *Chætostomus*, according to Pollard (**11.** p. 538 and p. 543), the mandibular branch is absent.

3. The Commissure.—The only commissure present in *Clarias nieuhofii* is that in the frontals, which establishes a connection between the canals of either side of the head. Pollard (**11.** p. 527) states that this commissure "is distinctly rudimentary and gives very strongly the impression that it formerly united with its fellow of the opposite side." Again, on p. 542 *op. cit.* he states "it is a complete commissure, but one becoming somewhat rudimentary." He does not state what species he examined, but in neither of those I have examined are there any signs of it becoming rudimentary. I note further that he omits in his figure (**11.** pl. 35. fig. 1) any sensory organs in this commissure, one being present in *Clarias magur* on either side of the median lines and innervated by the ramus ophthalmicus superficialis of the trigeminal nerve.

Innervation.

Clarias magur.

The nerves innervating the sensory canal system are the trigeminal, facial, glossopharyngeal, and vagus.

Of the trigeminal group the following branches innervate the canals and sensory organs:—

1. The ramus ophthalmicus superficialis.
2. The ramus buccalis.
3. The ramus oticus.

1. *The ramus ophthalmicus superficialis* is the most dorsal branch of the trigeminal and passes directly forwards. It gives off branches to all the sense-organs lying between the pores 16 to 19 on the supra-orbital branch. Slightly posterior to the frontal commissure a short branch passes off which innervates a sense-organ on the lateral border of the commissure. In the anterior

region the nerve divides into two branches, each of these again dividing into numerous fine twigs.

2. *The ramus buccalis* supplies all the sense-organs of the suborbital branch. It branches from the Gasserian ganglion above the ramus maxillo-mandibularis, to which it is connected by a fine branch. It passes forwards, crossing the floor of the orbit, and terminates in a series of fine branches. In its course forwards it gives off a series of fine branches which supply the sense-organs between the pores 10 to 15.

3. *The ramus oticus* innervates the greater portion of the main canal and the backwardly directed branch of the supra-orbital branch which terminates at pore number 9 (fig. 1). The ramus oticus passes above the facial (Pl. XVIII. fig. 1, *r.ot.*) and divides into two branches; the main branch passes backwards along the main canal and the other makes a lateral curve forwards and supplies the small branch which is given off from the supra-orbital branch and terminates at pore 9.

The Facial Nerve.—The only branch entering into connection with the sensory canal system is the ramus mandibularis. This nerve arises as a branch of the ramus hyomandibularis. The latter nerve traverses a canal in the hyomandibular bone, some little distance below which it divides into two; the ramus hyoideus passing ventrally and the ramus mandibularis forwards, giving off numerous branches to the mandibular portion of the operculo-mandibular branch of the sensory canal.

The Glossopharyngeal Nerve in *C. magur* does not run or arise in conjunction with the vagus, as Pollard (**11.** t. 35. fig. 1) has figured in *Clarias*, sp. In all the specimens examined I find it arises slightly dorsal to, and quite distinct from, the vagus. Its anterior branch passes dorsally, and the posterior one to the posterior portion of the main canal of the head.

The Vagus.—The ramus lateralis vagi passes off from the vagus as a lateral division. It sends off a short branch which passes to the commencement of the main canal; it then proceeds outwards and backwards, giving off a series of fine branches, which pass between the muscles and supply the sense-organs in the anterior region of the lateral canal.

2. AMIURUS CATUS.

General Description.

The sensory canal system of this fish has been briefly described by Ramsay Wright (**12**) and is also referred to by Allis (**1**). Very briefly I will give a summary of the observations of these two writers in order that I may not have to point out at any length the differences between our respective accounts.

The references made by Allis are very brief. Speaking of the operculo-mandibular canal in *Amia* he says (p. 473): "The mandibular and opercular portions of the canal develop as two distinct canals, uniting later with each other to form a continuous line, and then uniting with the main infra-orbital. These later connections in *Amia* are not always found in other fishes . . . in *Amiurus catus* although they unite to form a continuous line, *they do not unite with the main canal*[1]."

I shall endeavour to prove that in *Amiurus catus* the operculo-mandibular branch does join with the main canal of the head.

In the account given by Ramsay Wright (**12.** pp. 262–265) it is stated that the posterior portion of the lateral canal is detached from the remaining portion, which is scarcely correct, and that there is "no communication between the principal canal and that which is lodged in the preoperculum."

Whether or not Professor Ramsay Wright regards the mandibular portion as distinct from the preopercular portion I am unable to gather from his account. On p. 265 he speaks of "the canal which is lodged in the preoperculum and mandible" as if it were continuous; but on the same page he refers to the "independence of the mandibular branch,"—I take this to mean the operculo-mandibular branch.

In *Amiurus catus* there is no true lateral canal. In the posterior portion of the body are a series of short isolated dermal tubes. The interruptions are more frequent and the tubes shorter in the posterior region than in the anterior. Posterior to the operculum there is a coalescence of these short tubes, and a distinct, but very fine, canal is formed. At the point where the lateral canal enters upon the head a short backwardly directed branch is given off (Pl. XVIII. fig. 2, *x*), which passes over the supra-clavicle (*McMurrich*). Immediately after entering the skull an occipital commissure (Pl. XVIII. fig. 2, *Oc.com.*) is given off, which communicates with the main canal of the opposite side; a little further on a lateral branch passes off—the operculo-mandibular branch. The main canal passes forwards, giving off a short branch towards the median line, and posterior to the orbit divides into supra- and sub-orbital branches. The sub-orbital branch passes through a series of canal-bones forming a circumorbital series, from these it is continued forwards into the antorbital bone. The supra-orbital branch runs above the orbit, giving off at its junction with the main canal a short backwardly directed branch, which runs towards the mid-dorsal line; slightly in front of the orbit another similar branch is given off. Passing to the anterior region the supra-orbital branch traverses a small canal-bone (Pl. XVIII. fig. 2) and terminates at the base of the maxillary barblet.

Course of the Canals and Branches.

1. THE LATERAL CANAL consists of a series of isolated dermal tubes; in the posterior portion of the body they are exceedingly small, but become slightly larger in the anterior region. Each tube opens to the surface by one or more pores. Slightly behind the operculum the tubes anastomose with one another and form a fine canal, which gives off a backwardly directed branch

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[1] The italics are mine.—W. E. C.

which opens by a pore over the region of the supra-clavicle (*McMurrich*) (Pl. XVIII. fig. 2, *x*).

2. THE MAIN CANAL commences from the point where the above-mentioned branch leaves the lateral canal. It passes through the frontal opening by a pore, immediately in front of which the occipital commissure is given off; some little distance in front of this the main canal receives the operculo-mandibular branch. Its course is now directed forwards and inwards, two pores opening in front of the operculo-mandibular branch. At some little distance posterior to the orbit the canal divides into the supra- and sub-orbital branches.

The Supra-orbital Branch.—At the point of division a backwardly directed branch is given off, which passes towards the mid-dorsal line (Pl. XVIII. fig. 2) opening by pore number 12. The supra-orbital branch continues forwards above the orbit, giving off another branch, which also passes backwards and almost parallel to the main branch ; a little distance in front of this a pore opens to the surface, and the canal enters a small canal-bone, through which its passes, giving off a lateral branch which meets with the sub-orbital branch, thus establishing a connection between the two in front of the orbit. After leaving this bone it makes a lateral curve and terminates blindly at the side of the maxillary barblet.

The Sub-orbital Branch is formed by the lower division of the main canal. It passes forwards and outwards for a short distance, and then makes a curve beneath the orbit, passing through the infra-orbital series of canal-bones, and in the anterior region enters a small canal-bone—the antorbital of some authors; passing through this it opens on the inner side and communicates with the supra-orbital branch.

The Operculo-mandibular Branch.—I have already stated that this branch is connected with the main canal; this connection is established by four small drainpipe-like canal-bones which pass from the region of the posterior border of the hyomandibular bone to the lateral border of the frontal (Pl. XVIII. fig. 3, *c.b.*). Passing from the main canal into this series of canal-bones, and through the external portion of the hyomandibular bone, the canal enters the preoperculum; from here it passes into the distal portion of the quadrate and then into the mandible, opening by four pores in its course.

3. THE COMMISSURES.—The only commissure present is the occipital commissure, which connects the main canal of the head of either side with each other. There are two pores opening from it, being situated one on either side of the median line. There is no commissure in the anterior or frontal region.

Innervation.

The cranial nerves of *Amiurus catus* have been described by Ramsay Wright (**13**), and I have little or nothing to add to his account, excepting their relations to the sensory canal system [1].

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[1] The absence of careful figures makes this otherwise excellent account very difficult to follow, the figures on plates i. & iv. being very diagrammatic.

The whole of the sensory canal system of the head is innervated by the trigeminal, facial, and glossopharyngeal; the lateral canal is innervated by the lateralis division of the vagus.

The trigeminal group may be divided into the following main branches, viz.:—

1. The ramus ophthalmicus superficialis.
2. The ramus ophthalmicus profundus.
3. The ramus buccalis.
4. The ramus maxillaris.
5. The ramus mandibularis.
6. The ramus oticus.
7. The ramus lateralis.

Of these seven rami all but the rami ophthalmicus profundus, maxillaris, and lateralis innervate some portion of the sensory canals.

1. *The ramus ophthalmicus superficialis* is with the ramus lateralis, the most dorsal branch of the group. It passes off from the Gasserian ganglion immediately above the ramus ophthalmicus profundus, but not, as mentioned by Ramsay Wright (**13**. p. 366), through a large foramen. It traverses the dorsal border of the orbit, and then along the upper surface of the skull, supplying a series of cluster-pores in the region of the nasal capsule, and also the sense-organs of the supra-orbital branch.

2. *The ramus ophthalmicus profundus* lies immediately below the ramus ophthalmicus superficialis; after passing through the orbit it branches and enters into connection with the ramus ciliaris.

3. *The ramus buccalis* arises lateral to the ramus ophthalmicus profundus and beneath the ramus ophthalmicus superficialis. It passes forwards and divides into two branches; the lateral branch passes along the borders of the sub-orbital branch of the main sensory canal, to which it gives off a number of fine branches; the inner branch of the buccalis does not innervate any portion of the sensory canal system.

4 & 5. *The ramus maxillo-mandibularis.*—I cannot agree with Professor Ramsay Wright's diagram of these nerves[1] (**13**. pl. iv. fig. 1). In the final specimen I dissected, which measured 287 millim. in length, I found the ramus maxillaris considerably larger than the ramus mandibularis; the buccalis lies just above it (Pl. XVIII. fig. 2). A few small branches pass off to the integument, the main branch passing to the maxillary region and innervating the maxillary barblet, on which it divides in four branches, passing between the divided tendon of the retractor muscle.

The ramus mandibularis.—In its upper region it is connected with the ramus maxillaris, dividing into external and internal branches on the anterior edge of the mandibular adductor muscle; the former—the ramus externus—passes along the lower jaw, innervating the mandibular portion of the operculo-mandibular branch of the main sensory canal, it also communicates with the facial. The ramus internus passes on the inner side of the jaw to the mandibular barblets, &c. I failed to trace any branches of the ramus mandibularis passing to the maxillary barblet (*cf.* Ramsay Wright, **13.** p. 368).

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[1] Professor Ramsay Wright informs me that part of the work was done on *A. niger*, which may possibly account for some of the differences.

6. *The ramus oticus* is larger in *Amiurus catus* than in any of the types previously mentioned. It arises in close conjunction with the ramus ophthalmicus superficialis, passing from the brain through a foramen in the sphenotic. The most dorsal branch innervates the main canal; below this two other branches pass off, while the fourth or main branch passes to the upper portion of the sensory canal in the hyomandibular (Ramsay Wright says preoperculum). The innervation of this branch of the main canal by the ramus oticus is of special interest, as in most other fishes it is innervated by a branch of the facial nerve. Professor Ramsay Wright (**13.** p. 366) was the first to describe the distribution of this nerve in *Amiurus.*

The Facial Group.—No portion of the facial nerve, so far as I have been able to trace, innervates any portion of the sensory canal system. As previously pointed out, the descending branch of the ramus oticus replaces the hyomandibular branch of the facial in the upper portion of the operculo-mandibular canal, while the lower portion is innervated by the ramus mandibularis of the trigeminal, the mandibularis of the facial lying below it.

The Glossopharyngeal.—I have not been able to trace any connection between this nerve and the sensory canal system, although it seems very probable that the most posterior portion of the main canal of the head is innervated by it.

The Vagus.—The ramus lateralis vagi leaves the main branch just below the ganglion and passes posteriorly over the supraclavicle (*McMurrich*); just behind the ascending process of the supra-clavicle it gives off two branches, one passing above to the occipital commissure and the other laterally to the branch x (Pl. XVIII. fig. 2, l & l').

3. PIMELODUS MACULATUS.

General Description.

The sensory canal system of *Pimelodus* has not hitherto been investigated. Pollard (**11**) has described and figured that in *Auchenoglanis biscutatus*, a species of an allied genus.

In *Pimelodus* the lateral canal commences at the base of the caudal fin, and passes forwards as a direct line to the region of the head. From its commencement to where the canal passes over the transverse processes of the fourth and fifth vertebræ, which are here developed to an unusual extent (*cf.* Bridge and Haddon, **2.** pp. 119–25), there are from 85 to 95 pores, varying in number according to the age of the fish. In the region of the fourth and fifth vertebræ, the canal gives off two branches, one on either side of the canal, and from these a series of smaller branches and grooves arise, to which special mention will again be made. The canal enters the head just above the angle of the operculum, in which region a dendritic branching is plainly visible and indicates the region of the occipital commissure. Continuing forwards the operculo-mandibular branch passes in a bony canal through the preoperculum and mandible. Slightly in front of this the main canal divides into supra- and sub-orbital branches, the former passing forwards and inwards, and anterior to the nasal capsule, on the lateral border of which it terminates on the side of the nasal barblet. The sub-orbital branch passes around the orbit and forwards, bifurcating between the nares.

Course of the Canals and Branches.

1. The Lateral Canal commences at the base of the fin-rays of the caudal fin, and passes as a fine dermal tube to the region of the head. Opening into the canal at regular intervals are a series of pores averaging from 85 to 95 in number. Previous to entering upon the region of the head a short branch is given off which passes behind the occipital region (Pl. XVIII. fig. 1); a similar branch is given off in front of this, which passes downwards and backwards; both are surrounded by a series of dendritic branches and grooves (Pl. XVIII. fig. 5). These grooves present, I think, a stage in the formation of the branches. In the smallest specimens examined they were simple isolated grooves. In later stages they had sunk into the epidermis, and their sides were gradually converging; still later stages showed that the sides ultimately met and formed a minute canal opening by a terminal pore. In the last stage this minute canal becomes connected with the main canal or one of its branches. In addition to these cluster-pores there are, scattered in the immediate neighbourhood of the lateral canal, a series of small papilla-like organs, to which reference will be made later, it being sufficient to here remark that they are not organs in connection with the sensory canal system.

2. The Main Canal enters upon the region of the head above the angle of the operculum. On its inner side it gives off the occipital commissure, and slightly anterior to this a lateral branch—the operculo-mandibular: immediately in front of this the main canal divides into the supra- and sub-orbital branches (Pl. XVIII. fig. 4).

The Supra-orbital Branch is formed by the inner division of the main canal. Passing forwards and inwards in the frontals it gives off a short backwardly-directed branch and numerous dendritic branches terminating in cluster-pores. Slightly anterior to the orbit three small branches directed towards the median line are given off, and a short lateral branch between the nasal openings. A number of fine dendritic branches and grooves similar to those already mentioned (Pl. XVIII. fig. 5) are connected with all these. Between the supra-orbital branches of either side of the head are a large number of very small primitive pores.

The Sub-orbital Branch is the lateral division of the main canal. It is conducted around and below the orbit by three small canal-bones. After leaving the most anterior of these the branch is continued as a dermal canal around the lateral border of the nasal capsule and terminates by bifurcating. The dendritic branching is more easily distinguishable here than on the supra-orbital branch; very many of the branches, however, persist as grooves. The whole region of the main canal and its branches—excepting that of the operculo-mandibular branch—is densely covered by exceedingly minute primitive pores. In many cases they were not visible to the naked eye, but could be clearly distinguished with the aid of a low-power lens.

The Operculo-mandibular Branch leaves the main canal a little way in front of the occipital commissure. It passes through the preoperculum and continues along the mandible. At its commencement it gives off numerous fine dermal branches terminating in cluster-pores, the same feature being repeated where it joins with the mandibular portion. There are four large pores on the mandible and numerous small dermal branches and grooves. The branches of the two sides of the head are not connected with each other.

3. THE COMMISSURES.—The two commissures present in *Pimelodus* are an imperfect or rudimentary occipital one, whose presence is easily detected by the series of fine dendritic branches passing from it immediately above the angle of the operculum. The second commissure is that in the frontals (Pl. XVIII. fig. 4, *F.com.*). Like the occipital commissure, it gives off numerous fine dendritic branches. It is not so distinct as the frontal commissure in *Clarias*.

Innervation.

The distribution of the cranial nerves in *Pimelodus* resembles very closely the condition described and figured in *Clarias magur*.

The same four nerves are all that enter into relation with the sensory canal system, viz. the trigeminal, facial, glossopharyngeal, and vagus.

The branches of the trigeminal innervating sense-organs are:—

1. The ramus ophthalmicus superficialis.
2. The ramus buccalis.
3. The ramus oticus.

1. *The ramus ophthalmicus superficialis* has a similar course to this branch in *Clarias*. Fine branches pass off between the pores 25 to 31 to the sense-organs of the supra-orbital branch of the main canal and also to the frontal commissure. In the most anterior portion the nerve divides into two smaller branches, one passing forwards and around the border of the anterior narial opening, the remaining and smaller branch terminating at pore number 31 (Pl. XVIII. fig. 4).

2. *The ramus buccalis* differs slightly from that found in *Clarias* in being longer and in the number of its branches and commissures.

It crosses the ventral portion of the orbit, where a large branch passes off which is connected by a fine commissure with the ramus ophthalmicus profundus, and another with the main branch of the buccalis. The buccalis innervates all the sense-organs lying in the sub-orbital branch of the main sensory canal between the pores 18 to 24. The branches of the nerve lie dorsal to the ramus maxillo-mandibularis.

3. *The ramus oticus* has exactly the same course and distribution as in *Clarias*, innervating the anterior part of the main canal; the centre of the canal is supplied by the glossopharyngeal, and the posterior portion by branches from the lateral division of the vagus (Pl. XVIII. fig. 4).

The Facial, like as in *Clarias*, passes as a main branch through a bony canal in the hyomandibular, and after running ventrally for some short distance, divides into a ramus hyoideus and ramus mandibularis, this latter branch innervating the mandibular portion of the operculo-mandibular branch of the main sensory canal. It would appear that the mandibular rami of the fifth and seventh nerves are interchangeable as regards the innervation of the mandibular portion of the operculo-mandibular branch of the main sensory canal.

Dorsal to the ramus hyomandibularis two small branches arise (Pl. XVIII. fig. 4, *r.d.*), which do not innervate any portion of the sensory canal system and probably correspond to the branches *x* and *y* of Pollard and form the ramus dorsalis.

The Vagus has a similar distribution to that in *Clarias*. It lies immediately behind the glossopharyngeal, but is distinctly independent of it.

4. CALLICHTHYS LITTORALIS.

General Description.

The following notes have been made from an external examination of three perfect specimens and the body of a fourth. As I have not been able to inject the canals of the head or to examine the skull in detail, the specimens I examined being required for other purposes, I cannot criticise the account given by Pollard (11. p. 533). It should, however, be borne in mind, when comparing his figure (pl. 36. fig. 4) with that given on Pl. XIX. (fig. 6), that the specimen he investigated was a young one only 3 cm. in length.

1. THE LATERAL CANAL commences by a pore at the base of the fin-rays of the caudal fin. It passes forwards as a dermal canal until it reaches the fifth dorsal shield from the head, which it enters and is conducted forwards through the fourth, third, and second, passing into a small canal-bone instead of the first shield.

2. THE MAIN CANAL may be regarded as commencing in the aforementioned canal-bone, in which it opens by two pores. Passing into the squamosal it gives off a lateral and backwardly-directed branch running from pore number 4 to 5 (Pl. XIX. fig. 6).

It continues through the squamosal into the sphenotic and in the region of pore number 7 divides into two branches, viz. the supra- and sub-orbital.

The Supra-orbital Branch passes through the sphenotic into the frontal and makes a sharp turn to the region of pore number 9 (Pl. XIX. fig. 6), and then in an outward curve passes around the anterior nasal opening, where it terminates.

The Sub-orbital Branch passes posterior and ventral to the orbit in the sub-orbital bones, opening in its course by three pores.

In the specimens I examined, the operculo-mandibular branch differed from that figured and described by Pollard (**11**. p. 534) in that there is a distinct mandibular portion. It is not connected with the main canal of the head, but arises near the head of the preoperculum, through which it passes; opening by three pores it passes into the mandible, in which portion there is a single pore, number 4 (Pl. XIX. fig. 6).

The species examined by Pollard was *C. paleatus*. If the condition figured by this author is correct for *the adult* stages of *C. paleatus* and *Trichomyterus tenuis*—he examined only young forms of both—they are very interesting, and offer perhaps the simplest type of sensory canals in the Physostomi.

III. CYPRINIDÆ.

LABEO DUSSUMIERI.

I do not propose to describe the sensory canal system in *Labeo*, but wish to draw attention to the presence in this family of a series of sense-organs which, so far as I can learn, are peculiar to it.

Valenciennes[1] was the first, I believe, to make any mention of them, and later Bleeker[2] pointed out their presence. Neither of these authors described their structure, which was first detailed and figured by Leydig (**8**) in the thorough and careful manner characteristic of all this author's work[3]. It is rather singular, but I cannot find a single reference to this very important paper in any of the writings of recent workers upon the subject.

In *Labeo* there are distributed over the anterior region of the head and around the borders of the mouth a large series of pores of different sizes with overlapping edges standing above the level of the skin. These edges are quite smooth and unpigmented (Pl. XIX. fig. 7).

Each pore leads into a flask-shaped cavity varying in size according to the size of the pore (Pl. XIX. fig. 8). The latter average from 1 to 3 millim. in diameter in *Labeo dussumieri*, the cavity being from 3 to 10 millim. in depth. From the

[1] Cuvier et Valenciennes, Hist. Nat. des Poissons, 1842, vol. xvi.

[2] Bleeker, Atlas ichthyol. d. Indes-Orientales Néerlandaises, 1863, t. iii.

[3] The species described by Leydig are *Schismatorhynchus heterorhynchus*, Blkr., *Lobocheilus falcifer*, van Hass., and *Rohita vittata*, Val. Bleeker makes mention of their presence in various species of the following genera:—*Crossocheilus, Labeo, Lobocheilus, Schismatorhynchus, Epalzeorhynchus, Rohita, Diplocheilichthys, Morulius*, and *Danzila*.

sides of the walls of each cavity there arise a series of sensory filaments (Pl. XIX. figs. 8 and 9) into which a fine branch of a nerve passes. In *Schismatorhynchus heterorhynchus*, Leydig (**8**. p. 2) describes the walls as showing folds as figured (Taf. i. fig. 5). In *Labeo* these folds were scarcely discernible, probably owing to the fact that the material had been for some time in alcohol.

These interesting organs seem to me to be a series of specialized cluster-pores which have become isolated from the sensory canal system. There are a number of other "sense-papillæ," as Leydig terms them, common to certain *Cyprinidæ*, which have also probably originated as cluster-pores.

IV. Esocidæ.

Esox lucius.

General Description.

The sensory canal system of *Esox* has been previously investigated or referred to by Leydig (**7**), M'Donnell (**9**), Ramsay Wright (**12**), Allis (**1**), and others.

The system is a simple one and shows none of the complications previously met with in the Siluroids or Cyprinoids.

The lateral canal, like all the canals in *Esox*, is a wide tube passing from the posterior end of the body to the anterior, and joins the main canal of the head by passing through the supraclavicle and a somewhat **Y**-shaped canal-bone; the lateral arm connects the lateral canal of the trunk with the main canal of the head, which passes through the lateral border of the pterotic, and on the sphenotic divides into supra- and suborbital branches. The former passes through the frontal to a point slightly anterior to the lateral ethmoid, and then into a canal-bone lying on the lateral border of the anterior portion of the frontal. It terminates anterior to the nasal capsule some distance from the end of the snout. The suborbital passes over the sphenotic in a small ovoid canal-bone and is conducted around the orbit in a series of canal-bones. In front of the orbit it makes an upward turn and terminates at a pore lateral to the nasal capsule.

Passing through the preoperculum is a fairly large canal, which has no connection with the main canal or with that in the mandible. This last mentioned commences on the ventral surface of the mandible a little anterior to the articular portion, and passes to almost the end of the ramus. It is not connected with the branch of the opposite side.

In addition to the above canals and branches there are in *Esox* a number of open grooves upon the surface of the head posterior to the occipital region and in the nasal region.

Course of the Canals and Branches.

1. The Lateral Canal.—The presence of a canal on the lateral trunk of the body seems to have escaped the notice of previous

observers; thus M'Donnell (9. p. 175) describes the lateral canal as consisting of a series of isolated follicles each opening to the surface by a pore. Even so careful an observer as Leydig (7. p. 33) speaks of it as an interrupted canal, possibly being misled by the series of interrupted scales. Ramsay Wright (12. p. 265) also refers to it in like terms.

Notwithstanding these observations, there is a distinct and very large lateral canal in *Esox*. It commences about 12 millim. from the base of the caudal fin and passes as a wide tube as far as the supraclavicle. Its greatest transverse diameter is 5 millim. and its smallest 1 millim. It opens to the surface by a series of pores, each lying in a little pit. The canal lies beneath the scales in the dermis. The sensory organs lie slightly anterior to the pore.

In transverse section the canal exhibited the usual structure.

2. THE MAIN CANAL of the Head.—This canal enters the skull in the pterotic, through which it passes as a wide canal. M'Donnell (9. p. 175) states that the cephalic portion and the lateral line proper are not connected with each other. Probably he overlooked the portion traversing the supraclavicle and the Y-shaped canal-bone. The main canal terminates at the anterior end of the pterotic, giving rise to the supra- and sub-orbital branches.

The Supra-orbital Branch lies in the frontal bone. It is a simple wide canal opening to the surface by four large pore-like openings. From the frontal it passes into a canal-bone lying on the lateral border of the frontal, and terminates some little distance in front of the nasal capsule.

The Sub-orbital Branch first passes through a small oval-shaped ossicle lying upon the sphenotic, and continues its course through a series of canal-bones surrounding the orbit, in front of which it makes an upward turn and terminates by opening to the surface external to the nasal capsule.

The Opercular Branch.—Unlike the condition found in most fishes, the opercular branch is quite distinct from either the main canal of the head or the mandibular branch. Commencing at the head of the preoperculum as a large pore, it passes through this bone to its distal end, where it terminates by a similar pore. In its course through the bone it gives off three small branches, each of which opens to the surface by a pore.

The Mandibular Branch passes through the greater portion of the mandible as a closed canal opening to the surface by three pores, as well as one at its commencement and termination. It terminates about 13 millim. from the symphysis.

In *Esox* there are no true commissures connecting the canals of one side of the head with the other, but a series of open grooves upon certain regions of the head probably take their place. Behind the occipital region these are most pronounced. They commence on either side of the head from the pore on the inner arm of the Y-shaped canal-bone previously mentioned. Some portions of these grooves anastomose with each other in the median line, thus forming a connection between the canals of each side of the head. A similar series of grooves are present in the nasal region, these entering into connection with the terminal pore of the supra-orbital branch of the main canal. There is no anastomosis of the grooves of one side with the other.

Innervation.

In describing the cranial nerves of the Selachoid Ganoids (3) attention was drawn to the great development of the facial nerve. So far in the Physostomous Teleosts the trigeminal has been the larger, and this is perhaps more evident in *Esox lucius* than in any type previously described.

The sensory canal system is innervated by the same four groups, viz. the trigeminal, facial, glossopharangeal, and vagus.

The Trigeminal Group.—The branches supplying the sensory canal system are:—

1. The ramus ophthalmicus superficialis.
2. The ramus buccalis.
3. The ramus oticus.
4. The ramus mandibularis.

1. *The ramus ophthalmicus superficialis* is the most dorsal branch of the trigeminal group (Pl. XX. fig. 11). It passes forwards some distance above the orbit and divides into two smaller branches, which each terminate in a number of fine divisions some little distance from the snout. The nerve lies beneath the supra-orbital branch of the sensory canal, to which it gives off a series of fine twigs.

2. *The ramus buccalis.*—The main divisions of the trigeminal are the ramus buccalis and the ramus maxillo-mandibularis; the former is the anterior and more dorsal division and passes behind and beneath the orbit, and then across the side of the face, where it divides into two, each division further dividing into a number of fine twigs which spread themselves over the terminal region of the snout. From the main branch of the buccalis a fine branch passes off to the sub-orbital branch of the main sensory canal, giving off a series of fine twigs to the sensory organs (Pl. XX. figs. 10, 11).

3. *The ramus oticus* arises in close proximity to the ramus ophthalmicus superficialis. It passes posteriorly and divides into two, the dorsal branch innervating the main canal of the head (fig. 10, *r.ot.*).

4. *The ramus maxillo-mandibularis* is the largest division of the trigeminal group. It passes ventrally to the angle of the jaw, where it divides into internal and external mandibular branches. Some little distance above the internus the ramus maxillaris passes off (Pl. XX. figs. 10, 11). The ramus mandibularis externus innervates the mandibular canal; it passes on the ventral portion of the mandible and gives off two series of fine branches, one to the canal and the other to the integument. The ramus internus divides on the inner side of the mandible into numerous smaller branches (Pl. XX. fig. 12).

The Facial Group.—The only branch of the facial which I have been able to satisfy myself actually innervates a portion of the sensory canal system is the most posterior division of this group—the ramus hyoideus—which runs in the ventral portion of the preoperculum and innervates the canal which traverses that bone. The ramus mandibularis (Pl. XX. figs. 10, 11, *r.m.*) lies below the mandibular branch of the trigeminal and does not enter into relation with the branch of the canal. A small branch (Pl. XX. figs. 10, 11, *x*) in some cases was in very close relationship with the sub-orbital branch of the main canal, but no fibres could be traced to the sensory organs. There would seem to be no innervation to the upper portion of the canal in the preoperculum, neither the ramus oticus nor the glossopharyngeal entering that region.

The Vagus passes directly backwards, giving off a lateral branch and other smaller branches. The lateralis vagi lies dorsally as far back as the supraclavicle, passing beneath that bone, at a point about at its upper third; it then makes a downward curve to the region of the lateral canal, which it innervates.

V. SALMONIDÆ.

SALMO SALAR.

General Description.

The lateral canal commences at the base of the caudal fin and passes anteriorly as a dermal canal. In its course forwards it opens to the surface by a series of pores which pass between the scales, those scales in the region of the lateral canal being slightly modified.

It enters upon the head in the region of the pterotic bone, giving off an occipital commissure and, anterior to this, the operculo-mandibular branch. Posterior to the orbit it divides into supra- and sub-orbital branches, the former passing some little distance above the orbit and the latter through a series of canal-bones forming the circumorbital ring.

A number of variations in the branching and distribution of the main canal of the head and its branches were noted in the various specimens dissected. I shall first describe what I consider to be the typical form, and then make mention of some of the variations met with.

Course of the Canals and Branches.

1. The LATERAL CANAL is a dermal one like that in *Esox*; it commences at the base of the caudal fin, and in its course forwards opens to the surface by a series of pores which, as described above, pass between the scales, there being a slight modification in those scales in the region of the lateral canal.

2. The MAIN CANAL of the head is a fine canal enclosed within a series of small drainpipe-like canal-bones (Pl. XX. fig. 15), not unlike those figured and described in *Polyodon* (3. pl. 39. fig. 7, *e*). It enters upon the region of the head above the pterotic and gives off an occipital commissure in the occipital

region, and some little distance in front of this a lateral branch passes off—the operculo-mandibular branch. The canal then makes a slight ventral curve, and posterior to the orbit divides into supra- and sub-orbital branches.

The Supra-orbital Branch, like the main canal, is conducted in its course by a series of small drainpipe-like canal-bones. It passes forwards and inwards to a point directly above the orbit, and then makes a curve towards the nasal capsule, dorsal and anterior to which it terminates by a minute pore.

The Sub-orbital Branch passes from the main canal on the lateral border of the frontal in a series of canal-bones forming the circum-orbital series. These conduct the branch around the inferior and posterior borders of the orbit, the branch terminating ventral and slightly posterior to the nasal capsule.

The Operculo-mandibular Branch.—Leaving the main canal in the inferior and posterior portion of the pterotic, the operculo-mandibular branch passes into a small tube of bone which traverses the region between the pterotic and preoperculum, along the superior and posterior borders of the hyomandibular bone. Parker and Bettany regard this small tube-like bone as a supra-temporal. It cannot, I think, be regarded as other than one of the drainpipe-like canal-bones which conduct the main canal and branches over the greater part of the skull, and homologous with those figured and described in *Amiurus catus* (see p. 280). Entering the apex of the preoperculum, the canal traverses the anterior border, passing through the whole length of the bone. In its course it gives off fine branches, which are distributed over the inferior border of the bone; a number of finer branches pass off over the superior portion of the preoperculum. Leaving the preoperculum, a small dermal connection conducts the branch into the articular portion of the mandible, entering it on its lateral border. It passes downwards and forwards and into the dentary, traversing the ventral portion of the same. In the anterior portion of the dentary the branch divides in the substance of the bone, anastomosing previous to opening at a terminal pore. There is no connection between the two branches of either side.

3. The OCCIPITAL COMMISSURE leaves the main canal on the inner border of the pterotic, and makes an anterior flexure over the region of the supra-occipital, and meets with the main canal of the opposite side.

I have not figured or described the innervation, as the distribution of the cranial nerves is almost identical with that of *Esox lucius*.

Variation.

In the Salmon there seems to have once been a series of canals passing through certain bones of the head which have been replaced by the system borne by the series of drainpipe-like canal-bones already described.

In young examples a series of canals are easily traced in the parietal, frontal, supraethmoid (Parker), and nasal bones. These canals vary a little in different specimens, but, generally speaking, the actual distribution is the same; in fact they are a feeble facsimile of the more superficial complete canals.

I have already described how the occipital commissure passes off from the point of junction of the lateral canal and the main canal of the head. At this point a branch passes downwards into the substance of the parietal and frontal bones (Pl. XX. fig. 14) and in a lateral direction towards the border of the frontal bone, where it divides into three branches—a backwardly directed one to the region of the preoperculum, a forward and laterally directed one (a sub-orbital branch), and a forward one, which passes inwards for some distance, making an outward curve and passing through the supraethmoid (Parker) and terminating blindly in the nasal. Sometimes it passes only as far as the supraethmoid (Parker). In some cases it was very difficult to decide whether the branch leading to the preoperculum was present. In a very large specimen I thought there were indications of a small branch passing between the head of the preoperculum and the supra-orbital bone. Although connected with the more superficial system, none of these canals are functional.

VI. MURÆNIDÆ.

CONGER CONGER.

General Description.

The sensory canal system has not hitherto been worked out in the Conger. Arsaky (1836) has investigated the central nervous system, but I have been unable to refer to his work.

The lateral canal commences about 18 millim. from the tip of the tail and passes forwards in the integument. The pores distributed over its surface and opening into the canal are numerous. In the anterior region it passes slightly dorsally and enters upon the region of the head, terminating by opening into a wide saccular dilatation from which the occipital commissure arises, also the main canal of the head and the operculo-mandibular branch. The main canal passes through the frontal and divides into the supra- and sub-orbital branches, the former passing along the orbit, and terminating by a large pore in the most anterior portion of the face; the sub-orbital passes behind and beneath the orbit, terminating beneath the opening of the supra-orbital branch. In its course three large saccular dilatations are given off, the first of which opens by a large pore. The operculo-mandibular branch commences at the termination of the lateral canal. It gives off a saccular dilatation at its commencement and again at the base of the opercular portion, and a third slightly in front of this; it then passes forwards along the mandible, opening in its course by four pores, and meets with its fellow of the opposite side.

Course of the Canals and Branches.

1. The LATERAL CANAL passes in the integument from the posterior end of the body, 16 millim. from the end of the trunk, exclusive of the caudal fin, to the region of the head. In the

anterior portion it makes a slight dorsal curve and terminates on the region of the head by opening a wide saccular dilatation. The pores distributed along the surface of the canal are numerous, averaging in the posterior half of the body 7 to every 2 cm.

2. THE MAIN CANAL of the Head.—As previously mentioned, at the point where the lateral canal terminates there is a wide saccular dilatation, out of which the main canal opens. As soon as this dilatation has been cut open the entrance to the main canal appears as a definite circular opening. Its border is surrounded by a ring of cartilage, and the rest of the canal by a series of cartilages similar to that figured on Pl. XXI. figs. 18, 19. In very large and old specimens this cartilage becomes partially ossified. The canal passes inwards and downwards and through the frontal bone, returning to the surface again slightly posterior to the orbit, and divides into the supra- and sub-orbital branches. There are no other branches passing off from the main canal, and no pores opening to it from the surface of the head. The diameter of the canal is very irregular; in the posterior portion it is fairly wide, but narrows considerably previous to passing into the frontals. In the anterior portion, prior to its division into the two orbital branches, it widens again.

The Supra-orbital Branch passes inwards and forwards after leaving the main canal, and as an almost straight branch passes to the tip of the snout, where it opens by a large pore posterior and dorsal to the anterior nares (Pl. XXI. figs. 16, 17).

The Sub-orbital Branch passes behind the orbit and some distance below it; before passing forwards beneath the orbit a large saccular dilatation passes backwards and opens by a large pore (Pl. XXI. figs. 16, 17). Passing forwards to a region above and slightly in front of the angle of the mouth, another but shorter dilatation passes off, and, like the former, opens by a pore; still further anterior is a third, into which the finger can be readily inserted. There is no pore opening from this. The branch now enters a cartilage and passes upwards and then downwards and forwards, and terminates by a large pore beneath the opening of the supra-orbital branch.

The Operculo-mandibular Branch commences immediately at the termination of the lateral canal. At its very commencement and just below the wall of the lateral canal is a pore which leads into a large saccular dilatation which passes backwards and slightly ventrally, terminating blindly. Passing downwards, enclosed in a series of cartilages, it again widens at its base into another much larger dilatation, which opens to the surface by a pore; slightly in front of this is another dilatation, somewhat smaller (Pl. XXI. fig. 17). The branch continues forwards, and, passing inwards, opens into the mandible, through which it passes, opening to the surface by four pores and meeting with its fellow of the opposite side. The connection is formed by a short canal in the cartilage.

The mandible is peculiarly modified for the reception of the mandibular portion of the operculo-mandibular branch, a large portion of the ramus being broken up into a bony network.

3. The OCCIPITAL COMMISSURE passes off as an inward branch immediately in front of the lateral canal, and almost opposite to the operculo-mandibular branch (Pl. XXI. figs. 16, 17). Like all the other branches, it is enclosed in a series of more or less isolated cartilages. It traverses the occipital region of the head and forms a connection between the main canals of either side of the head.

The distribution and branching of the sensory canal system in *Conger conger* resembles in a many ways that figured in *Clarias*. The large saccular dilatations are perhaps the most peculiar feature in connection with the form of the canal, etc., but branches occur in *Clarias* in these several positions.

This form of canal has not previously been described in the Physostomi, I believe, and it cannot be regarded as at all typical of this suborder. Leydig (6) was the first to draw attention to these peculiar cartilages enclosing the canals of this form, and in 1850 he figured and described them in *Lota vulgaris*.

I shall have to refer to this account later when treating of the suborder Anacanthini and to compare it with Hyrtl's account and some investigations of my own.

On Pl. XXI. figs. 18, 19, I have figured the cartilage which connects the occipital commissure with the large saccular dilatation, from which the main canal of the head and the operculo-mandibular branch pass off. Each cartilage forms a drainpipe-like structure, averaging from 20 to 44 millim. in length, the walls of which consist of a dense connective tissue, with numerous cartilage cells scattered throughout. Towards one end and on one side of the cartilage a series of white patches are present, which remind one of the terminal cartilages on the bronchial tube of many vertebrates; these are denser patches of cartilage. On the dorsal surface and towards the end not possessing these cartilaginous patches is a small ossification. This was not found to be present on all the cartilages. Each cartilage is connected with its fellow by a prolongation of the connective tissue, as shown in figure 18, these overlapping the sides of the cartilage at the end, *a*, fig. 19.

The presence here of a dense connective tissue, isolated chondrifications, and an ossification afford an interesting example of the manner in which canal-bones may have originated.

Innervation.

The specialization in the form of the sensory canals, as has been described in *Conger*, is accompanied by a greater development of the cranial nerves and an increase in the branching.

The nerves of the trigeminal group are all large branches, and, excepting the ramus oticus, pass forwards. The branches which innervate the canal system are:—

1. The ramus ophthalmicus superficialis.
2. The ramus buccalis.
3. The ramus maxillaris.
4. The ramus oticus.

1. *The ramus ophthalmicus superficialis* is the first branch passing from the Gasserian ganglion. It is covered for a part of its course by the branches of the olfactory nerve. It arises from the ventral side of the Gasserian ganglion and gives off a series of fine branches, which innervate the supra-orbital branch of the main sensory canal (Pl. XXI. figs. 16, 17).

2. *The ramus buccalis* innervates the anterior portion of the sub-orbital branch of the main sensory canal. Its distribution is somewhat different from that figured and described in *Esox.* It divides posterior to the orbit into two branches, both of which pass forwards to the region of the snout. In *Esox* this division takes place anterior to the orbit.

3. *The ramus maxillaris* together with the *ramus mandibularis* forms the main branch of the trigeminal nerve. It passes forwards and downward towards the orbit, on the border of which it divides, sending a branch (Pl. XXI. figs. 16, 17 *r.mx.*^{1}) to the posterior and inferior portions of the sub-orbital branch of the main sensory canal; this again divides, forming the branch *r.mx.*^{2} (fig. 17) which innervates the saccular dilatation number 4. *The ramus mandibularis* does not innervate any portion of the canal system.

4. *The ramus oticus* innervates the whole of the main canal of the head. It consists of two main divisions, which further divide into numerous fine twigs.

The Facial nerve innervates the terminal portion of the lateral canal and the operculo-mandibular branch of the main canal. The chief division, represented in *Esox* by the ramus hyomandibularis (Pl. XX. figs. 10, 11, *r.hy.*), is somewhat different in *Conger* (Pl. XXI. figs. 16, 17, *r.hy.*). Below the lateral border of the frontal bone, and upon the upper portion of the hyomandibular bone, it divides into two main branches; the smaller (fig. 17, *r.op.*) passes posteriorly beneath the opercular portion of the sensory canal. Its main branch is continued backwards for some little distance and innervates a large sensory organ in the saccular dilatation number 1, and the last sensory organ in the lateral canal. The two smaller divisions do not innervate any portion of the canal system.

The larger branch, the ramus hyomandibularis (fig. 20, *r.hy.rm.*), passes along the side of the operculo-mandibular branch of the main sensory canal and divides into a mandibular and hyoidean branch. Branches from the former pass to the lower part of the opercular portion of the operculo-mandibular branch, to the saccular dilatations numbered 2 and 3, and also to the mandibular portion of the canal.

The Glossopharyngeal Nerve.—I have been unable to trace any portion of this nerve to the main canal. It seems, however, to replace the anterior and dorsal branches of the vagi lateralis and innervates the two sensory organs in the occipital commissure.

The Vagus is very similar to that described in *Esox*, excepting that there are no anterior branches given off from the vagi lateralis.

VII. Summary.

The more important features set forth in the foregoing pages may be summarized as follows:—

(*a*) The sensory canal system in the Physostomous Teleostei is widely removed from that present in the Elasmobranchi, but shows many affinities to that in the Ganoidei, *e. g.* the manner in which the canals and branches are protected and the dermal character of the lateral canal, in many forms.

(*b*) The species of the different families differ largely from one another, and in some particulars either agree with more specialized or generalized fishes; *e. g.* in *Salmo* the main canal of the head and the supra- and sub-orbital branches &c. are protected by a series of small drainpipe-like canal-bones not unlike those described and figured in *Polyodon* and *Acipenser* (**3**. p. 524), while in *Conger* and partly in the *Siluridæ* the branching is not unlike that which obtains in many Anacanthinous forms.

(*c*) The cluster-pores and primitive pores are in the majority of cases few in number, as are also the sensory organs in the canals and branches.

(*d*) In the Siluroids the results obtained support the view that the sensory canal system in this family is one which once was much more complicated in its nature and has since degenerated.

The facts which favour such a view are:—

a. The fewness and smallness of the cluster-pores.
b. The exceedingly minute primitive pores.
c. The dimensions of the canals and branches.
d. The many indications, in various bones, of pre-existing canals.

(*e*) Excepting in *Callichthys* and *Esox* all the branches on the head pass off from the main canal.

(*f*) The presence of grooves in various stages of development in *Pimelodus* affords an instance of the manner in which the canals are formed and further how in their earlier condition they resemble that common to the adults of more generalized fishes.

(*g*) The succession of canals in *Salmo* is exceedingly interesting, showing as it does a series of functionless canals passing through the substance of the bone and which once probably communicated with the surface by a series of pores. By a later anastomosis of these pores and a growth of small drainpipe-like ossifications a second and more superficial series of canals arose, which gradually replaced altogether those traversing the deeply-seated cranial elements.

(*h*) Wherever the branching of the main canal and branches is great, and the sensory organs in the same more numerous, there is a corresponding increase in the branching of the trigeminal group of nerves.

(*i*) The nerve-supply is fairly constant throughout the suborder, but there is some slight interchangeability, which is set forth in the following table:—

Trigeminal.

Ramus ophthalmicus superficialis *Ramus buccalis* *Ramus oticus*	Fairly constant, supplying main canal and the supra- and sub-orbital branches.

In *Amiurus* the ramus oticus supplies the upper part of the opercular portion of the operculo-mandibular branch.

In *Amiurus* the ramus ophthalmicus superficialis supplies the cluster-pores. In *Conger* the ramus maxillaris may supply posterior part of the sub-orbital branch.

Ramus mandibularis. May either supply mandibular portion of the operculo-mandibular branch (*Amiurus*) or no portion of the canal system (other types).

Facial. Supplies the operculo-mandibular branch. In *Conger* also supplies a sensory organ in lateral canal.

Glossopharyngeal. May either innervate a portion or the whole of the main canal or the occipital commissure only, or it may not supply any portion of the canal system (*Amiurus?*).

Vagus. May or may not by anterior branches supply the initial portion of the main canal of the head.

It will be seen, from the above tabular view of the nerves, that the innervation proceeds very largely from the trigeminal group of nerves. I have pointed out in previous papers (3 and 4) that in the Elasmobranchii the canal system was supplied solely by the facial group; in the Ganoidei the same feature still obtained, with the addition of a larger innervation from the ramus oticus, and also a portion of the system in *Polyodon* was supplied by the ramus mandibularis of the trigeminal.

In most of the species examined the glossopharyngeal nerve innervated some portion of the main canal or the occipital commissure (excepting *Amiurus?*), replacing the branch of the vagus lateralis marked l′ in *Polyodon* (cf. 3. pl. 40. fig. 11).

With the exception of *Amia*, in which Allis (1) states that the glossopharyngeal nerve innervates a single sense-organ and a series of what he terms "pit-organs"—probably synonymous with what I have called "primitive pores"—the Physostomi are the most generalized class of fishes in which such a condition is found.

The innervation of any portion of the canal system by the glossopharyngeal nerve is certainly a characteristic feature in Teleostean fishes. *Amia* is probably the only Ganoid in which such a condition obtains.

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EXPLANATION OF PLATES XVIII.–XXI.

Fig. 1. Diagrammatic view of the head of *Clarias*, illustrating the distribution of the sensory canal system of the head and the nerves innervating their sense-organs. The canals and branches are coloured yellow, the trigeminal nerve blue, and the facial red.

Lettering.

c.b.	Canal-bone.
f.	Frontal.
F.com.	Frontal commissure.
hyom.	Hyomandibular.
l.	Vagi lateralis.
l'.	Anterior branch of vagi lateralis.
L.C.	Lateral canal.
m.	Mandible.
M.C.	Main canal.
m.pt.	Metapterygoid.
Oc.com.	Occipital commissure.
op.	Operculum.
Op.-Mn.	Operculo-mandibular branch of main sensory canal.
or.	Orbit.
p.op.	Preoperculum.
qu.	Quadrate.
r.b.	Ramus buccalis.
r.hm.	Ramus hyomandibularis.
r.hy.	Ramus hyoideus.
r.m.	Ramus maxillaris.
r.mn.	Ramus mandibularis (trigeminal).
r.m'.	Ramus mandibularis (facial).
r.o.p.	Ramus ophthalmicus profundus.
r.o.s.	Ramus ophthalmicus superficialis.
r.ot.	Ramus oticus.
s.op.	Sub-operculum.
S.or.	Sub-orbital branch of main sensory canal.
Sp.o.	Supra-orbital branch of main sensory canal.
V.gl.	Vagus ganglion.
Vg.	Vagus.

Fig. 2. Diagrammatic view of the sensory canal system in the head of *Amiurus.* (Lettering as above.)

Fig. 3. Figure showing the series of canal-bones, *c.b.*, in *Amiurus*, which connect the main canal of the head with the operculo-mandibular branch. From the series of canal-bones, *c.b.*, the canal passes first into a portion of the hyomandibular, *hyom.*, then into the preoperculum, *p.op.*, and finally into the quadrate, *qu.*

Fig. 4. Diagrammatic view of the sensory canal system in the head of *Pimelodus.* (Lettering as before.)

Fig. 5. Dendritic branches and grooves from the sub-orbital and operculo-mandibular branch of the main sensory canal of *Pimelodus.*

Fig. 6. Lateral view of the head of *Callichthys littoralis*, showing the distribution of the sensory canal system.

Fig. 7. Lateral view of the head of *Labeo dussumieri*, showing the distribution of the sense-organs. × 1. (Drawn by Mr. F. W. Crispe.)

Fig. 8. Longitudinal section through one of the flask-shaped sense-organs in *Labeo dussumieri*, showing the pore, *p.*, and the sensory filaments, *s.fl.*, arising from the walls of the cavity. The nerve innervating the sense-organ is shown at the base, *n.f.*

Fig. 9. Sensory filament, highly magnified; the nerve fibre, *n.f.*, passes up the filament for nearly two-thirds of its length and then divides into a number of very fine branches, which terminate around the disc, *d.*

Fig. 10. Diagrammatic view of the sensory canal system in the head of *Esox* and distribution of the trigeminal and facial nerves.

Fig. 11. Lateral diagrammatic view of the same.

Fig. 12. Diagram illustrating the distribution of the mandibular branches of the trigeminal and facial nerves in *Esox.*

Fig. 13. Lateral diagrammatic view of the sensory canal system in *Salmo.*

Fig. 14. Dorsal view of the same. The sensory canals are coloured yellow. Those canals which are no longer functional and pass through the cranial elements are indicated by a double black line.

Fig. 15. Canal-bones from the main canal of the head of *Salmo.*

Fig. 16. Dorsal diagrammatic view of the sensory canal system of *Conger* and innervation of the same. The figures 1 to 6 indicate the saccular dilatations. *r.op.*, Ramus opercularis. Other lettering as above.

Fig. 17. Lateral diagrammatic view of the same.

Figs. 18, 19. Cartilages from the occipital commissure of the sensory canal system of *Conger.*

2. Remarks on some Cranial Characters of the Salmonoids.

By G. A. BOULENGER, F.R.S.

[Received March 27, 1895.]

Various attempts have been made to split up the Salmonoids into families and subfamilies. In his classification of 1871 [1], Prof. Cope proposed to separate the Coregonidæ from the Salmonidæ owing to their having the parietal bones united in front of the supraoccipital, whilst they are separated by the latter bone in the Salmonidæ proper. In a recent paper, Dr. T. Gill [2] controverts Cope's statement, remarking that "on examination of a skull of *Coregonus*" he finds the same relation of the bones as in *Salmo*, whilst the arrangement ascribed to *Coregonus* is characteristic of *Thymallus*. For this reason *Coregonus* is retained in the Salmonidæ and *Thymallus* is raised to family rank; the author adding that the Thymallidæ are further distinguished from the Salmonidæ by the presence of epipleurals and the greater development of the dorsal fin, many of the anterior rays of which are unbranched. The last feature, by itself, is too trivial to be used as a family character; and the first characteristic is unfounded, *Salmo* and *Coregonus* having well-developed epipleurals.

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[1] Trans. Amer. Philos. Soc. (2) xiv. 1871, p. 454.

[2] Proc. U.S. Nat. Mus. xvi. 1894, p. 117.

As to the condition of the parietal bones, it seems curious that there should be divergence of opinion on a point so easy to ascertain even in spirit-specimens. It is not stated to what species of *Coregonus* the skull belongs on which Gill's observation is based, but all the examples I have examined in the British Museum, skeletons and alcoholics, of European and American species of that genus, show the parietals forming a more or less extensive suture between the frontals and supraoccipital, as ascertained by Cope. I am therefore at a loss to account for Gill's statement to the contrary.

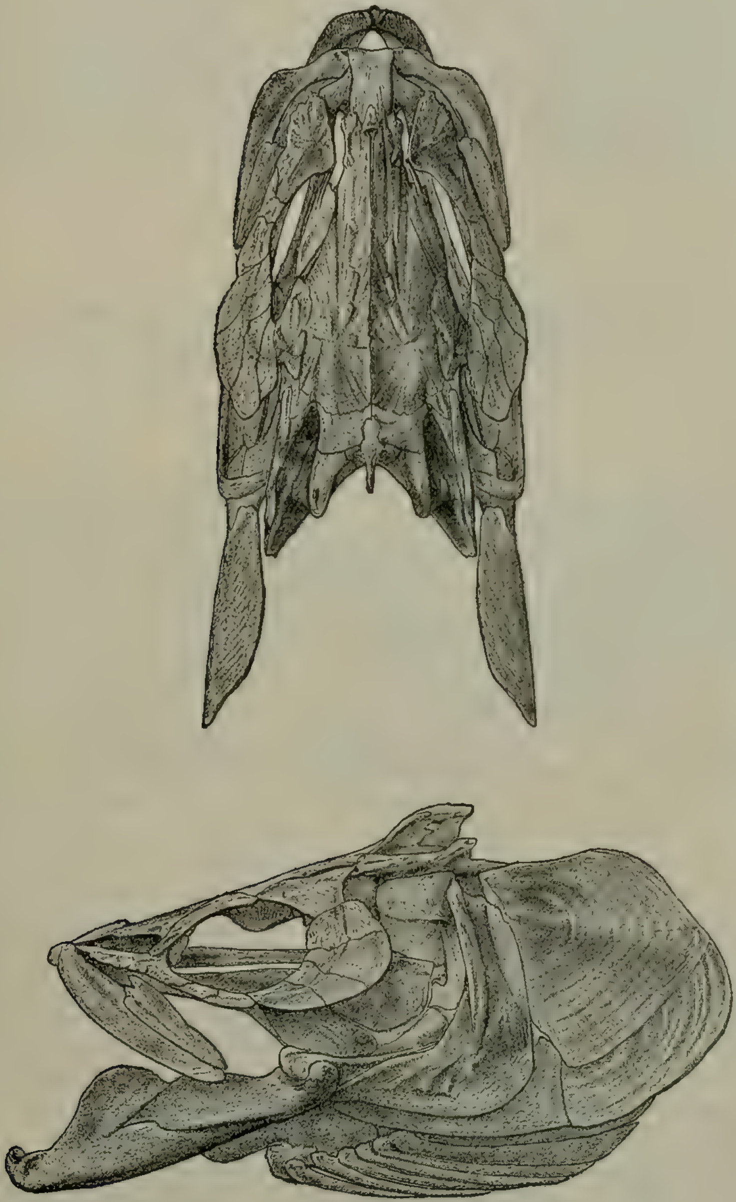
I have also examined *Brachymystax*, which, from its very small scales combined with a small mouth, holds a position intermediate between *Salmo* and *Coregonus*; the supraoccipital separates the parietals, as in *Salmo*.

In his paper quoted above, Gill founds a subfamily, Stenodontinæ, in the family Salmonidæ, for the curious genus *Stenodus*, Rich. (*Luciotrutta*, Gthr.), without having been able, however, to examine the skeleton. A large head of the "Inconnu," *Stenodus mackenzii*, from the Mackenzie River, was presented by Mr. Walter Gordon Cumming to the Museum a few weeks ago, and I have had it prepared as a skull in order to supplement this gap in our knowledge of Salmonoid osteology. This skull is here figured.

It will be seen that Gill's statement, "lower jaw articulating with the quadrates behind the eyes," is not quite correct, the articulation of the mandible falling below the posterior border of the orbit, in this respect intermediate between *Salmo* and *Coregonus*. The posterior process of the quadrate is very long and slender. The supraorbital is very large and in contact with the postorbital. But what is especially noteworthy is the condition of the supraoccipital and parietals, the latter bones forming a very short suture, separating the former from the frontals, a condition which is, in fact, intermediate between the two types mentioned above. On examining a smaller specimen of *Stenodus mackenzii* and a specimen of the Russian *S. leucichthys*, I find no union whatever between the parietals, and therefore the character to which Cope and Gill have attached so great an importance falls to the ground.

It must be remarked, however, that, as I have ascertained by removing the parietals in specimens of *Coregonus williamsonii*, the supraoccipital joins the frontal. Therefore even in *Coregonus* and *Thymallus* the relation is a widely different one from that obtained in Cyprinoids and Characinoids, the apparent resemblance being merely due to the fact that in the Salmonoids in question the parietals extend over the supraoccipital, whilst in *Salmo* they are the frontals which overlap the supraoccipital.

Fig. 1.



Upper and side views of the skull of *Stenodus mackenzii*. ($\frac{1}{2}$ nat. size.)

The result of the investigation that I have undertaken is that there is no reason for separating *Coregonus* and *Thymallus* from the Salmonidæ.

I also wish to observe on this occasion that the Percopsidæ, which are not included in Cope's synopsis and are placed in "Suborder uncertain" by Gill, are most nearly allied to the Salmonidæ. As in *Salmo*, the supraoccipital completely separates the parietals. Prof. Stewart, who has kindly examined bones of *Percopsis guttatus* and *Columbia transmontana* at my request, informs me that he has been unable to find a trace of lacunæ, although these are present in the bones of *Salmo*, *Coregonus*, *Thymallus*, *Stenodus*, *Microstoma*, and *Argentina*; he, however, finds them likewise absent in *Osmerus*, *Hypomesus*, *Retropinna*, *Salanx*, and *Plecoglossus*.

3. On certain Features in the Skull of *Osteoglossum formosum*. By Prof. T. W. Bridge, M.A.[1]

[Received March 28, 1895.]

(Plate XXII.)

While recently examining a skeleton of a specimen of *Osteoglossum formosum*, Müll. et Schl., in the Zoological Museum of Mason College, I noticed one or two interesting features in connection with the skull which, so far as I have been able to discover, have not previously been described. The only reference to the skull with which I am acquainted is by Hyrtl in his "Beitrag zur Anatomie von *Heterotis ehrenbergii*, C.V." (Denkschr. d. Akad. Wiss. Wien, Bd. viii. 1854, pp. 73–88). In this paper the author briefly compares the skeleton of *Osteoglossum* with that of *Heterotis*; but although the comparison extends to certain features in the structure of the skull in the two genera, Hyrtl makes no reference whatever to those structural modifications in the skull of *Osteoglossum* to which I desire to direct attention.

On examining the base of the skull of *Osteoglossum formosum* the parasphenoid (Pl. XXII. figs. 1 and 2, *ps.*) is seen occupying its normal position, firmly attached to the ventral surface of the basioccipital behind, and, from that point, extending forwards beneath the cartilaginous interorbital region to its junction with the dentigerous vomers anteriorly. As the parasphenoid passes between and beneath the two prootic bones it forms the floor of a median canal for the muscles of the eyeball, the roof of which is, as usual, formed by the mesial union of the two prootics in the floor of the cranial cavity. At this point the parasphenoid gives off from its lateral margins two well-marked processes on each side: first, an ascending process (*ps.l.*) which passes obliquely upwards, in contact with the anterior margin of the prootic of its side, and finally terminates above by overlapping the outer surfaces of the prootic (*pr.o.*), the sphenotic (*sp.o.*), and the

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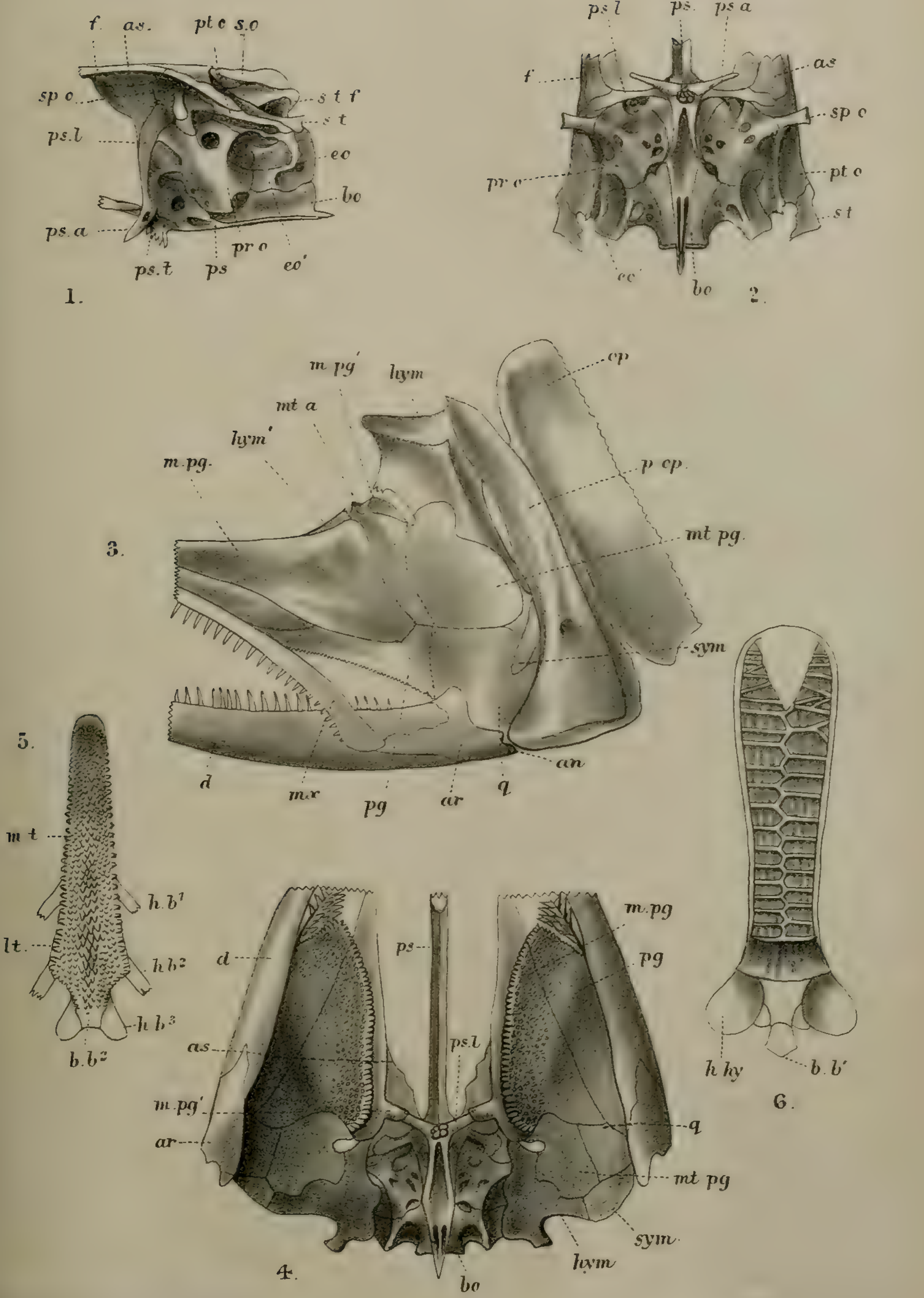
[1] Communicated by Dr. Günther, F.R.S.



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SKULL OF OSTEOGLOSSUM FORMOSUM.

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alisphenoid (*as.*) bones at the point where the three are in sutural connection with one another near the antero-superior angle of the auditory capsule (fig. 1). This process is, undoubtedly, the equivalent of the conspicuous ascending or lateral process of the parasphenoid in certain Ganoids, which it also closely resembles in its extensive relations to the anterior wall of the auditory capsule, and, more particularly, in its extension so far dorsally as to overlap the sphenotic region—an extension which, so far as I am aware, has no parallel in any other Teleost, although characteristic of such Ganoids as *Acipenser*, *Polypterus*, and *Amia*. The second of the two processes (figs. 1 and 2, *ps.a.*) is about 13 mm. in length and grows out on either side from the lateral margin of the parasphenoid, immediately ventrad to the root of the ascending process, and tapers to a free distal extremity. The process is horizontally disposed, at right angles to the long axis of the parasphenoid, or, at any rate, has but a very slight upward inclination from its root outwards, and is furnished with smooth rounded surfaces. This process may be termed the articular process of the parasphenoid. Midway between the roots of the two articular processes, and projecting downwards from the ventral surface of the parasphenoid, there is a mesially situated tubercle of bone (fig. 1, *ps.t.*) which supports a small cluster of teeth. These are small but variable in size, conical in shape, with pointed crowns, and so arranged that the two largest teeth occupy the hinder margin of the cluster, while about six smaller teeth are closely grouped together immediately in front of them.

The formation of special articular processes in connection with the parasphenoid is correlated with certain modifications in the mandibular arch, whereby the latter acquires a special articular connection with the former. The metapterygoid (figs. 3 and 4, *mt.pg.*) occupies its normal position as the proximal element of the arch. Posteriorly, the bone overlaps the external surface of the inferior half of the hyomandibular (*hym.*) and the contiguous outer surface of the symplectic (*sym.*); anteriorly, the metapterygoid is, in turn, overlapped on its inner surface by the mesopterygoid (*m.pg.*), while inferiorly it is firmly articulated to the superior margin of the quadrate (*q.*). The mesopterygoid (fig. 3, *m.pg.*) is the largest of the palato-pterygoid series, of which it forms the upper two-thirds. It is somewhat triangular in shape, the apex being directed anteriorly towards the palatine region, while the wider posterior portion overlaps the inner surfaces of the metapterygoid and quadrate bones. Inferiorly, the bone is firmly united to the pterygoid (*pg.*) throughout its entire length. The pterygoid (*pg.*) forms the inferior third of the palato-pterygoid series of bones, overlapping the inner surface of the quadrate behind, while externally, and for at least the anterior half of its length, it is rigidly attached to the inner surface of the dentigerous maxilla. A distinct palatine element is either non-existent or entirely cartilaginous, at any rate no trace of a palatine bone could be detected in the specimen examined.

As far as could be seen in the dried skull, the usual connection between the anterior extremity of the palato-pterygoid bar and the lateral ethmoid of its side must have been of a loose ligamentous character. Between the metapterygoid and the parasphenoid there is a singular articular connection. From the antero-superior angle of the metapterygoid a process (fig. 3, *mt.a.*) is bent inwards towards the base of the skull and lies in the horizontal plane. The anterior and posterior margins of the process are curved slightly upwards in such a way that the process forms a somewhat shallow, demi-cylindrical, articular surface, the concavity of which looks directly upwards. The mesopterygoid (figs. 3 and 4, *mp.g.*^{1}), which, as already mentioned, overlaps the inner surface of the metapterygoid, is also bent horizontally inwards, but at its postero-superior angle, and, moreover, partially embraces the preceding process in such a way as to strengthen the floor and, at the same time, deepen the sides of the demi-cylinder. The hyomandibular also contributes to the formation of this curious articular surface. A process[2] from the anterior margin of the superior half of that bone (fig. 3, *hym.*^{1}) is prolonged obliquely downwards and forwards, and, after blending with the anterior lip of the demi-cylinder, becomes applied to the adjacent upper margin of the mesopterygoid (*m.pg.*). It will be seen, therefore, that this process not only strengthens the anterior wall of the demi-cylinder, but, in addition, furnishes the latter with an incomplete roof. In the normal condition of these parts the articular processes of the parasphenoid fit into the two demi-cylindrical articular surfaces provided for them by the metapterygoids, in such a way, that a lateral sliding motion of the latter on the parasphenoid is possible.

In addition to the acutely-pointed teeth in the premaxillæ, maxillæ, and vomers, both the mesopterygoid and pterygoid bones carry teeth of variable size over nearly the whole extent of their inner or oral surfaces. The inferior border of the pterygoid (fig. 3, *pg.*) carries a series of small pointed teeth arranged parallel to the more externally situated and larger maxillary teeth (*mx.*). The rest of the inner surface of the bone (fig. 4, *pg.*) exhibits a granular appearance, from the presence of numerous, extremely fine, closely-set teeth. For the same reason the greater part of the oral surface of the mesopterygoid (*m.pg.*) has a very similar appearance, but, within a short distance of the superior margin of the bone, the fine denticles are replaced by a single longitudinally disposed row of much larger, conical, pointed teeth (fig. 4). Of these teeth the most posterior are the largest, and, moreover, are situated exactly opposite the mesial cluster of teeth in the parasphenoid; from this point forwards the teeth gradually but rapidly diminish in size. The teeth are slightly curved, and hence their pointed enamel-tipped crowns are directed obliquely inwards and a little downwards towards the corresponding teeth of the opposite side of the oral cavity, instead of being at right angles to the surface of the mesopterygoid like the remaining teeth which this bone supports.

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[2] I am inclined to think that this process is not an actual extension of the hyomandibular, but, on the contrary, is really an ossified ligament.

From this description it is apparent:—

i. That the various bones which form the proximal half of the mandibular arch and its palato-pterygoid bar are firmly rigidly connected with one another, and also with the corresponding elements of the hyoid arch—that is, with the hyomandibular and symplectic bones.

ii. That, in consequence of the articular connection of the hyomandibular with the periotic capsule, and the metapterygoids with the articular processes of the parasphenoid, combined with the looseness of the ethmo-palatine connection, the whole series of bones on each side are capable of a more or less extensive inward and outward movement, accompanied at the same time by the lateral contraction or expansion of the oral cavity. It is also clear that while the hyomandibular articulation with the skull and the nature of the ethmo-palatine connection will give the necessary mobility to the rigidly connected series of bones considered as a whole, the sliding character of the joint between the metapterygoids and the parasphenoid will give precision to such movements by strictly limiting them to the alternate approximation and separation of the bones of opposite sides of the head.

iii. That, as the result of such movements, the linear series of obliquely set teeth in the two mesopterygoids become opposable in the median line of the oral cavity, and, in conjunction with the mesial teeth in the parasphenoid, form part of an additional oral masticatory mechanism, distinct from the usual mechanism which is furnished by the upper and lower jaws and their teeth.

I have no knowledge of the character of the food of *Osteoglossum*, but, whatever may be its nature, it is evident that the food is subject to some kind of mastication in the oral cavity by the two parallel series of mesopterygoid teeth after its seizure in the first instance by the ordinary jaws. From this point of view there seems to be a fairly close analogy between *Osteoglossum* and the Crayfish, inasmuch as the relative functions of the mandibles and the gastric mill in the latter would seem to be performed by the ordinary jaws, and by the mesopterygoid and parasphenoidal teeth respectively in the former. In fact the analogy becomes even more precise if we consider that the relative position and relations of the mesopterygoid and parasphenoidal teeth in *Osteoglossum* are essentially similar to those of the zygocardiac and urocardiac teeth in the gastric mill of the Crustacean. It may be pointed out, however, that the two series of mesopterygoid teeth can scarcely come into actual contact in the median line of the oral cavity, but, on the other hand, it is certain that they can be brought so close together as readily to effect the crushing or more or less complete mastication of food which has been taken into the mouth.

In discussing the functions of the oral masticatory mechanism of *Osteoglossum* the singular dentigerous "tongue" of this fish, and its functional relations to other parts of the mechanism, must not, however, be left out of consideration. This organ (fig. 5) is an elongated band-like structure, somewhat broader behind than in front, and consists of a continuous plate of tooth-bone confluent below with the upper surfaces of the large basihyal and the two most anterior of the basibranchial elements. The tooth-bone carries over the whole extent of its upper or oral surface an extensive series of closely-set teeth, the largest of which are arranged in three parallel longitudinal rows—a lateral series (*l.t.*) along each outer margin of the "tongue," and a mesial row (*m.t.*) along the centre. The lateral teeth, although somewhat smaller, are very similar in shape and disposition to the linear series in each mesopterygoid, and, like the latter, diminish in size from behind forwards; the central teeth, on the contrary, are smaller in size, obtusely conical in shape, and much less regularly arranged. Between the three principal series of "lingual" teeth the surface of the "tongue" has a granulated appearance from the presence of a number of minute, conical, closely-set teeth. In its natural position in the mouth the linear series of lateral teeth are vertically opposable to the corresponding series of mesopterygoid teeth, while the mesial series lie between and below the latter. It is probable, therefore, that all three series of teeth (viz. the mesopterygoid, the parasphenoidal, and the "lingual") co-operate in effecting the mastication of the food—the mesopterygoid teeth by means of their lateral motion in the horizontal plane, and the lingual teeth through their vertical movements, or possibly, but improbably, by a kind of rasping action.

The capacity for lateral movement on the part of certain of the oral bones is by no means peculiar to *Osteoglossum*. In the Pike (*Esox*), for example, and probably also in many other Teleosts, there can be no doubt that the proximal elements of the hyoid and mandibular arches and the various bones of the palato-pterygoid series are capable of similar movements as a more or less rigid whole, and that, in consequence, the jaw-system is similarly capable of lateral expansion and contraction. The capacity of the bones in question for lateral movement is no doubt of great service in widening the gape and thereby adapting the jaws for seizing relatively large prey, or it may be of considerable advantage in enabling the fish to firmly retain its possibly struggling prey in the oral cavity prior to the act of swallowing, or even in effectually aiding deglutition itself; but, at the same time, it is extremely doubtful if anything of the nature of oral mastication can be effected by these means. On the other hand, in none of the ordinary Teleosts is there any articulation between the metapterygoid and the base of the skull, and whatever lateral mobility the bones under discussion possess is entirely due to the nature of the hyomandibular-pterotic and the ethmo-palatine articulations. The special peculiarity of *Osteoglossum* lies in the fact that, while the jaws are capable of the same kind of lateral movement as in the Pike, there is, in addition, a secondary articulation of the metapterygoid with the skull, the result of which is to give an altogether exceptional precision to such movements in accordance with the requirements of the highly specialized oral masticatory apparatus of this fish.

I am unable to say how far the possession of the mechanism is peculiar to *Osteoglossum formosum* among the Osteoglossidæ. It would certainly be interesting to ascertain whether it is restricted to this species, or is shared by either, or both, of the two remaining species of the genus, viz. *O. bicirrhosum* and *O. leichardti*; and also whether the mechanism is present in the sole remaining genera of the family, *Heterotis* and *Arapaima*.

It has been remarked that the peculiar metapterygo-parasphenoidal articulation of *Osteoglossum formosum* has no parallel in any other Teleostean fish, but it is nevertheless interesting to remark that an essentially similar mechanism is to be found in *Lepidosteus osseus*. In this Ganoid the basicranial articular surface for the metapterygoid is formed in part by a lateral outgrowth from the parasphenoid, and partly also by a descending process from the adjacent portion of the prootic, the former process forming the inner, and the latter the outer half of a transversely-elongated condyle provided with smooth, rounded, anterior and ventral surfaces. In his valuable paper on the "Development of the Skull in *Lepidosteus osseus*" (Phil. Trans. Roy. Soc. 1882) the late Professor Kitchen Parker refers to these condyles under the name of "basipterygoid processes," and describes them as being ossified by the alisphenoids. It is difficult, however, to see how this can be the case, at any rate from an examination of the adult skull. The processes in question certainly seem to be formed to an equal extent by the parasphenoids and the prootics, and are widely separated from the alisphenoids. The connection between the proximal elements of the hyoid arch and the corresponding bones of the mandibular arch is neither so intimate nor so rigid as in *Osteoglossum*; but, on the other hand, the metapterygoid, quadrate, pterygoid, and mesopterygoid bones are very firmly and rigidly united together by overlapping sutures. The metapterygoid (see Parker, *loc. cit.* plate 37. fig. 4, *mt.pg.*) is inclined obliquely downwards and forwards, so that the long axis of the bone makes an acute angle with the anterior section of the skull. The upper or cranial extremity of the bone is furnished with a transversely disposed concave surface for articulation with the condyle provided for it by the parasphenoid and prootic. The palato-pterygoid series consists of a relatively small mesopterygoid, which overlaps the dorsal borders of the pterygoid and quadrate bones; and an exceptionally large pterygoid, firmly applied posteriorly to the inner surfaces of both the metapterygoid and the quadrate, and gradually tapering to a thin, flexible, splint-like anterior portion. The latter part of the pterygoid (see Parker, *l. c.* plate 37. fig. 3, *pg.*) forms part of the slender rostral portion of the skull, and is situated between the parasphenoid (*pa.s.*) and vomers (*v.*) mesially, the superficial palatine (*pa.*^{1}) and the segmented maxilla (*mx.*^{1})

externally, and the frontal (*f.*) and ethmo-nasal (*et.n.*) bones above. The bones forming the lateral portions of the rostrum or snout—that is, the pterygoid, the superficial palatine, and the divided maxilla—are firmly connected together, but their connection with the mesial elements of the rostrum—the parasphenoid, vomers, and ethmo-nasals—is loose and ligamentous. The usual ethmo-palatine articulation is apparently altogether wanting in *Lepidosteus*; but the necessary lateral mobility of the palato-pterygoid series in front is secured, (i.) by the flexibility of the thin anterior portion of the pterygoid, and (ii.) by the loose ligamentous connection which has been described as existing between the palato-pterygoid series, including the maxillæ, and the mesial bones of the beak. The place of the normal ethmo-palatine joint is apparently taken by a secondary articulation furnished by a smooth oval surface on the inner side of a preorbital process of the frontal and a similar facet on the superior border of the pterygoid. It may be concluded, therefore, that, as in *Osteoglossum*, the palato-pterygoid series of bones are capable of more or less extensive lateral movement as a rigid whole on the metapterygo-parasphenoidal and the pterygo-frontal articulations, and, further, that such lateral movements are accompanied by the alternate approximation and separation of the two pterygoid bones in the mesial line of the oral cavity.

As regards the character of the teeth supported by the oral bones, *Lepidosteus* differs considerably from *Osteoglossum*. Apart from the acutely pointed teeth in the maxillæ, there is a series of similar but much smaller teeth in the superficial palatines, and also a number of closely-set denticles on the vomers and on a limited area of the oral surface of each pterygoid. These teeth, however, can only be of service in the vertical movements of the ordinary jaws, and even in the case of the pterygoid teeth it is obvious, from their position, size, and mode of implantation, that they can have no functional significance in connection with the lateral mobility of their supporting bones. It is possible that, as in *Esox*, the lateral mobility of the palato-pterygoid bones and the maxillæ is simply to admit of the lateral expansion of the jaws when seizing relatively large prey; but although this may be one of the advantages which the fish derives from this mechanism, the probability that the partially swallowed prey may be subjected to a process of crushing in the oral cavity by the lateral movements of the pterygoids must, nevertheless, not be lost sight of. It may also be remarked that the latter suggestion is strongly supported by the fact that the superior or inner edges of the two pterygoid bones are capable of being brought into actual contact in the median line of the mouth-cavity for a considerable portion of their length.

There is another interesting feature in which *Lepidosteus* resembles *Osteoglossum*, and that is the structure of the "tongue." In the Ganoid the floor of the mouth is elevated to form a well-marked, elongated, and somewhat strap-shaped "tongue," which terminates anteriorly in a free extremity loosely attached by a fibrous frænum (Plate XXII. fig. 6). The upper or oral surface of the "tongue" is invested by two parallel rows of small, somewhat rectangular, bony plates. Over the greater part of the length of the "tongue" the plates in each longitudinal row are firmly connected together by interdigitating sutures, and also, in the median line, with the plates of the other row; but, as the bony plates become gradually smaller and less regular in shape towards the free extremity of the "tongue," the two rows become separated by a median area of relatively soft skin. The oral surfaces of the plates are extremely rugose, and as the sutural lines between the various plates of each row form somewhat elevated ridges, it follows that in addition to the general rugose character of the oral surface of the "tongue" the latter is further complicated by a double series of short transversely disposed bony ridges. Inferiorly, the two series of bony plates are supported by an exceptionally large, forwardly directed basihyal (see Parker, *l. c.* plate 37). In its natural position in the mouth the "tongue" is situated in the median line between, but immediately below, the two pterygoid bones, and at the point where these bones are capable of the maximum extent of lateral movement, precisely as is the case in *Osteoglossum*. The function of the tongue it is difficult to ascertain with certainty. That it takes some part in the process of mastication seems, from its structure and relations, highly probable, but its precise mode of action is uncertain. If the organ is capable of a rasping motion it may aid the mastication of the food when the latter is firmly held by the mesial apposition of the pterygoids, or, as has already been suggested in the case of *Osteoglossum*, the "tongue" may co-operate by its vertical movements with the simultaneous lateral crushing movements of the pterygoids in the process of mastication. In any case the close resemblance in all important details between *Lepidosteus* and *Osteoglossum* as regards the structure, position, and relations of the "tongue" renders it very difficult to avoid the conclusion that the organ has the same physiological value in each fish, and the difficulty becomes greater if we bear in mind that the resemblance extends also to the essential modifications and relations of the various oral bones in the two genera.

In conclusion it may be said that *Osteoglossum* and *Lepidosteus* agree in possessing an oral masticatory mechanism constructed on an essentially similar plan, although it is evident from the preceding description that certain relatively slight special modifications exist in each case. Especially is the agreement shown by a feature which is unique among fishes, and that is, the development of a secondary movable articulation between the proximal element (metapterygoid) of the mandibular arch and the skull, which, in consequence, assumes a quasi-amphistylic condition. *Osteoglossum* is, without doubt, a very generalized Teleost, and it may be mentioned that there are several features in the skull and in other portions of the skeleton which support this view;

but, at the same time, it is equally clear that there can be no direct phylogenetic relation between the two genera. Hence the independent development of an essentially similar mechanism in two such widely distinct fishes can only be regarded as an interesting and striking example of parallelism in evolution.

EXPLANATION OF PLATE XXII.

[The figures are all of natural size.]

Fig. 1. Lateral view of the hinder part of the skull of *Osteoglossum formosum*, showing the lateral and articular processes of the parasphenoid and the mesial cluster of parasphenoidal teeth.

2. Ventral view of the same structures.
3. Lateral view of the bones of the proximal portions of the mandibular and hyoid arches, including also the proximal part of the lower jaw, the hinder section of the maxilla, and the articular surface on the metapterygoid. The dotted line indicates the extent to which the mesopterygoid and pterygoid bones overlap the inner surfaces of the metapterygoid and quadrate respectively. The process of the hyomandibular (*hym.*^{1}) has been partially removed.
4. Ventral view of the same structures, showing the two opposable series of mesopterygoid teeth, the parasphenoidal teeth, and the mode of articulation of the metapterygoid with the two lateral condyles furnished by the parasphenoid.
5. The oral surface of the "tongue," showing the three principal series of teeth, the attachments of the first three pairs of hypobranchial bones, and the second basibranchial element.
6. Similar view of the "tongue" of *Lepidosteus osseus*, showing the arrangement of the two rows of rugose plates, the attachment of the hypohyals, and the first basibranchial cartilage.

Reference Letters.

[The lettering is uniform throughout.]

an.	Angular.
ar.	Articular.
as.	Alisphenoid.
b.b.^{1}, *b.b.*^{2}.	First and second basibranchials.
bo.	Basioccipital.
d.	Dentary.
eo.	Exoccipital.
eo.^{1}	Lateral plate of exoccipital.
f.	Frontal.
h.b.^{1}, *h.b.*^{2}, *h.b.*^{3}	First, second, and third hypobranchials.
h.hy.	Hypohyal.
hym.	Hyomandibular.
hym.^{1}	Process of hyomandibular.
l.t.	Lateral "lingual" teeth.
m.pg.	Mesopterygoid.
m.pg.^{1}	Prolongation of mesopterygoid on the inner surface of metapterygoid.
m.t.	Mesial "lingual" teeth.
mt.a.	Articular surface of metapterygoid.
mt.pg.	Metapterygoid.
mx.	Maxilla.
op.	Operculum.
pg.	Pterygoid.
p.op.	Preoperculum.
pr.o.	Prootic.
ps.	Parasphenoid.
ps.a.	Articular process of parasphenoid.
ps.l.	Lateral or ascending process of parasphenoid.
ps.t.	Parasphenoidal teeth.
pt.o.	Pterotic.
q.	Quadrate.
s.o.	Supraoccipital.
sp.o.	Sphenotic.
s.t.	Supra-temporal.
s.t.f.	Supra-temporal fossa.
sym.	Symplectic.
v.	Vomer.

4. Notes on several rare Palæarctic Birds.

By H. E. Dresser, F.L.S., F.Z.S.

[Received April 2, 1895.]

Some time ago Professor Menzbier of Moscow forwarded to me the type of his *Gecinus flavirostris* to compare with Mr. Hargitt's type of *G. gorii*. This, on comparison, Mr. Hargitt found to be conspecific with his species, so that his name of *gorii* becomes a synonym of *G. flavirostris*. He then told me that he was very desirous to examine a specimen of Dr. Radde's *Picus minor*, var. *quadrifasciatus* (Orn. Cauc. p. 315, pl. xix. fig. 5), which he thought would probably prove to be a good species, and which he had included in the Cat. B. Brit. Mus. (xviii. p. 256), as such, under the name *Dendrocopus quadrifasciatus* (Radde). I therefore wrote to my friend Dr. G. Radde, who at once most courteously forwarded to me one of his type specimens, which I now exhibit. Directly I received it I wrote to Mr. Hargitt to arrange a meeting so that we could compare it together, and received a reply from Miss Hargitt to say that her brother was ill and confined to his bed. From this, unfortunately, he never again rose, and we all have to mourn the loss of an excellent ornithologist and certainly our best authority on the Woodpeckers.

Owing to Mr. Hargitt's death I have had to compare the specimen in question myself, and, as will be seen, it has, as stated by Dr. Radde, only four white transverse bands on the wing, instead of five as is usually the case in *P. minor*; but on the one wing the fifth bar is present though only slightly developed. I have here several specimens of *P. minor* from Northern Europe for comparison, and two of these have, as will be seen, only four bars on one wing and five on the other. Hence it would appear that *P. quadrifasciatus* is only a variety of *Picus minor*, with which it agrees closely in every other respect except that it is somewhat smaller in size, measuring culmen 0·61 inch, wing 3·5, tail 2·05, and tarsus 0·6. The underparts are also somewhat brown in tinge, but not browner than in several other North-European specimens of *P. minor*.

Besides the specimen of *P. quadrifasciatus*, Dr. Radde sent his type specimen of *Lanius minor*, var. *obscurior* (Orn. Cauc. p. 282, pl. xviii. fig. 2), which I also exhibit, together with several specimens of *L. minor* from Southern Europe. As will be seen, Dr. Radde's specimen differs only in being rather duller in tone of colour, and is, as suggested also by Dr. Radde, merely an individual variety of *L. minor*.

The Pied Flycatcher of the Caucasus, however, of which I have received several specimens, two of which I now exhibit, is a good species, differing both from *Muscicapa atricapilla* and *M. collaris* in having a semicollar and in having much more white on the tail than in either of those species. It was described and figured by Mr. E. F. von Homeyer under the name of *Muscicapa semitorquata* (Zeitschr. d. gesammt. Orn. 1885, p. 185, pl. x.). Mr. Homeyer had before him six specimens from the Caucasus, all of which agreed closely *inter se* in the characters given, in which this species differs from the other two species of Pied Flycatchers. I have in my own collection a fine adult male of *M. semitorquata* from Turkey, obtained many years ago by the late Mr. Robson; and on examining the series in the British Museum, I find that the specimens from Fao on the Persian Gulf, Bushire, and Persia are referable to this species, and not to *M. atricapilla* nor to *M. collaris*. It would therefore appear that *M. atricapilla* does not range further east than Turkey nor *M. collaris* than Asia Minor, being replaced east of those countries by *Muscicapa semitorquata*.

In conclusion I may add that Dr. Radde has also sent me several Long-tailed Titmice from Lenkoran and Tiflis, all of which are undoubtedly referable to *Acredula caucasica* and not to *A. caudata*.

5. The Skeleton of *Lorius flavopalliatus* compared with that of *Psittacus erithacus*.—Part I. By ST. GEORGE MIVART, F.R.S.

[Received March 25, 1895.]

In a former paper, read on March 5, 1895, I described the hyoid bones of certain Parrots and, amongst them, compared those of *Lorius flavopalliatus* with the same parts in *Psittacus erithacus*, having taken the latter as my type and standard of comparison.

The admirable works of Professor Alphonse Milne-Edwards on the Fossil Birds of France and on the Osteology of the Psittaci do not contain figures or descriptions of any species of *Loriidæ*, and the same must be said of Bronn's 'Thierreich' and (with a quite insignificant exception) of Fürbringer's magnificent publication in two folio volumes.

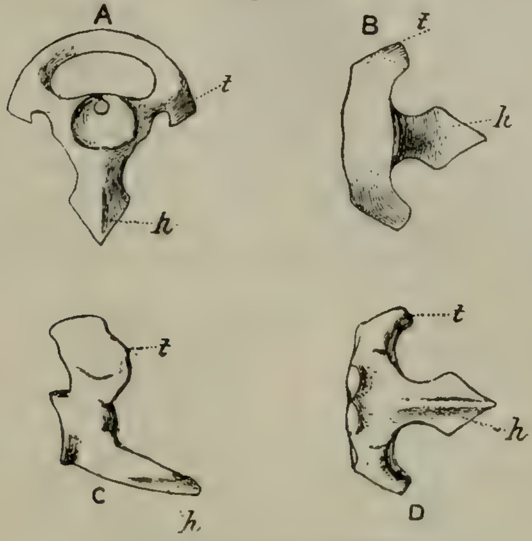
Such being the case, I have thought it worth while to describe in some detail the axial skeleton of a species of that interesting family which may possibly represent a more or less primitive form of the whole Order.

I have selected for description the skeleton of *Lorius flavopalliatus*, the means so to do having been furnished me by this Society through the courtesy of our Prosector, Mr. F. Beddard, F.R.S. For the purpose of comparison with the skeleton of *Lorius*, I have again chosen that of the type of the order *Psittaci*, namely *Psittacus erithacus*; and I have to thank the late President of the Linnean Society, Mr. Charles Stewart, Hunterian Professor, for the loan of a skeleton of that species, and also Mr. Beddard for a spirit-specimen, the bones of which have been prepared for me by Mr. Ockenden with his wonted skill.

THE CERVICAL VERTEBRÆ.

The *atlas* in *L. flavopalliatus* (fig. 1) has its pseudocentrum distinctly and largely perforated towards the dorsal part of its articular

Fig. 1.

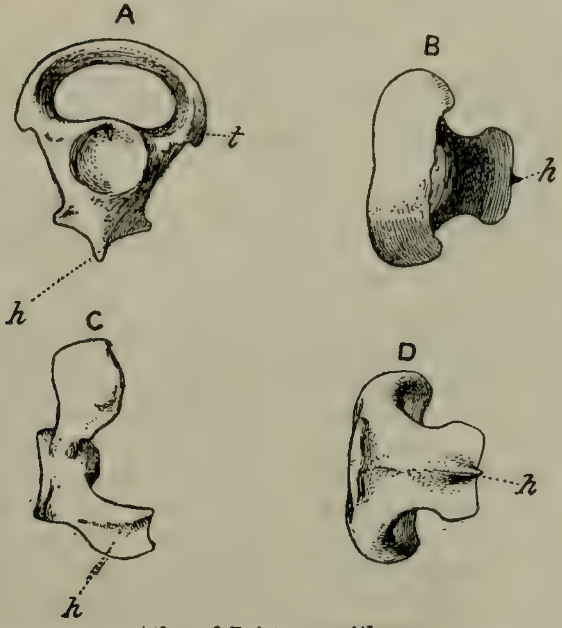


Atlas of *Lorius flavopalliatus*.

A. Anterior aspect. B. Dorsal aspect. C. Lateral aspect.
D. Ventral aspect.

h. Hypapophysis. | *t*. Transverse process.

Fig. 2.



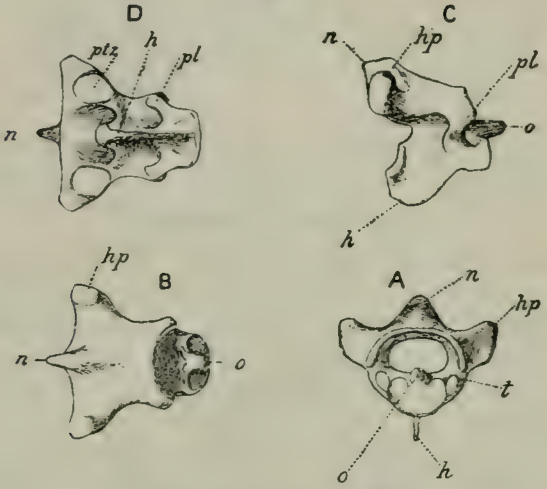
Atlas of *Psittacus erithacus*.

A. Anterior aspect. B. Dorsal aspect. C. Lateral aspect.
D. Ventral aspect.

h. Hypapophysis. | *t*. Transverse process.

cup, with a slight median notch above the perforation, the two portions bounding the latter dorsally not fusing together in the middle line but leaving a suture there. In *P. erithacus* (fig. 2, p. 313) the perforation is very much smaller and there is no suture above it. There is but a mere trace of a transverse process to be detected where the neural arch of the vertebra joins its lateral crura. Such a process is distinct in *L. flavopalliatus*, and it extends not only outwards but somewhat ventrad. The hypapophysis (*h*) is also relatively larger, hastate in shape, and more pointed than in *P. erithacus*, while its median ventral ridge is less strongly developed.

Fig. 3.



Axis of *Lorius flavopalliatus*.

A. Anterior aspect. B. Dorsal aspect. C. Lateral aspect.
D. Ventral aspect.

h. Hypapophysis.
hp. Hyperapophysis.
n. Neural spine.
o. Odontoid process.
pl. Pleurapophysial lamella.
ptz. Postzygapophysis.
t. Transverse process.

The *axis* in both (figs. 3 and 4) has a very small odontoid process (*o*), but only in *L. flavopalliatus* a small perforated transverse process (*t*), the delicate pleurapophysial lamella (*pl*) exhibiting a minute postaxiad process on its hinder margin. The neural spine is relatively, as well as absolutely, smaller, and the postzygapophyses, with very prominent hyperapophyses[1] upon them (*hp*), project more outwards and less backwards, making the lateral margin of the vertebra, seen dorsally, more concave. The hypapophysis (*h*) projects rather more backwards and less downwards, and the inferior margin of the vertebra, viewed laterally, is less strongly concave than in *P. erithacus*.

The *third vertebra* (figs. 5–10), viewed laterally, has, in both species, the outer margin of the longitudinal groove on the ventral surface of the (*p*) parapophysis, or parapophysial lamella, more sharply developed than in the axis; the neural spine is more dorsad, the apices of the hyperapophyses (*hp*) even somewhat preaxiad. The hinder margin of the pleurapophysial lamella (*pl*) shows an inclination to develop two superimposed, postaxiad prominences.

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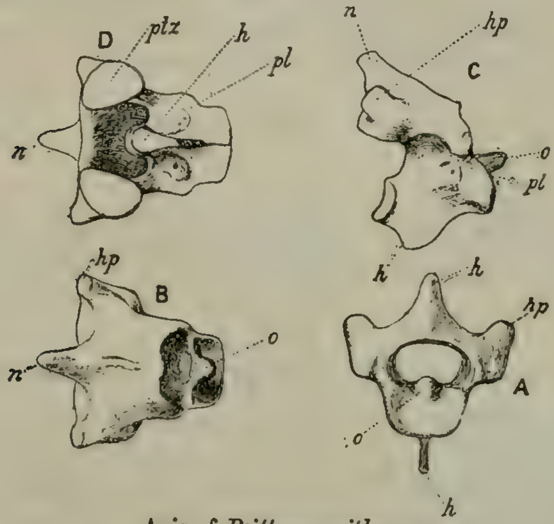
[1] So named by me in P. Z. S. 1865, p. 574, and Trans. Z. S. vol. viii. p. 390.

Fig. 4.



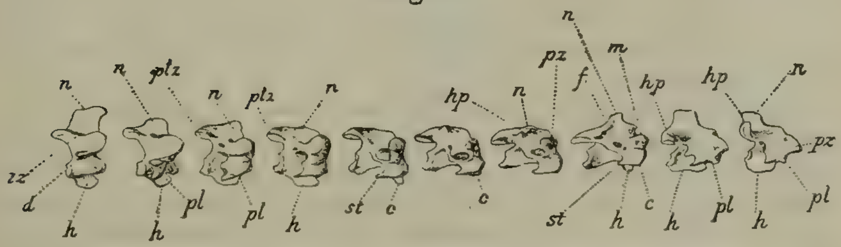
Axis of *Psittacus erithacus.*

A. Anterior aspect. B. Dorsal aspect. C. Lateral aspect. D. Ventral aspect.

h. Hypapophysis.
hp. Hyperapophysis.
n. Neural spine.

o. Odontoid process.
pl. Pleurapophysial lamella.
ptz. Postzygapophysis.

Fig. 5.



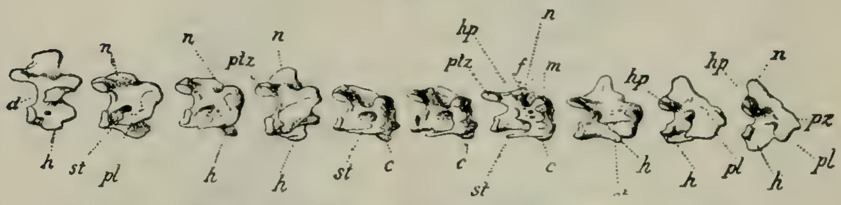
Lateral aspect of 3rd to 12th vertebræ of *Lorius flavopalliatus.*

c. Catapophysis.
d. Diapophysis.
f. Foramen.
h. Hypapophysis.
hp. Hyperapophysis.
iz. Interzygapophysial ridge.

m. Metapophysis.
n. Neural spine.
pl. Pleurapophysial lamella.
ptz. Postzygapophysis.
pz. Prezygapophysis.
st. Styliform process.

The *fourth vertebra* has, in both species, the prezygapophyses (*pz*) extending much preaxiad. In *L. flavopalliatus* the neural spine (*n*) is quadrate and directed almost exclusively dorsad, instead of being obtusely pointed and directed postaxiad as in *P. erithacus.* The postzygapophyses are almost entirely devoid of hyperapophyses. There are small and flattened ones as in *P. erithacus.* The postaxial margin of the pleurapophysial lamella also shows two superimposed postaxiad processes, the more ventral of which is continuous with the ridge bounding externally the antero-posterior groove on the ventral surface of the parapophysial lamella. The prezygapophysis bears a small prominence on its outer surface, which becomes noteworthy in the next vertebra.

Fig. 6.



Lateral aspect of 3rd to 12th vertebræ of *Psittacus erithacus.*

c.	Catapophysis.
d.	Diapophysis.
f.	Foramen.
h.	Hypapophysis.
hp.	Hyperapophysis.
m.	Metapophysis.
n.	Neural spine.
pl.	Pleurapophysial lamella.
ptz.	Postzygapophysis.
pz.	Prezygapophysis.
st.	Styliform process.

The *fifth vertebra* has the postzygapophyses much lengthened in both species, but especially in *L. flavopalliatus*, in which also the neural spine is smaller and more quadrate in outline. It arises some distance behind the preaxial end of the neural arch. In both species the hyperapophyses (*hp*) have the form of two small ridges diverging postaxiad from the hinder end of the base of the neural spine—more marked in *L. flavopalliatus*, in which species the hypapophysis is small and extends preaxiad from just behind and below the anterior central articular surface.

The ventral margin of the vertebra is much more antero-posteriorly concave than in *P. erithacus.* The ventral antero-posterior groove on the parapophysial lamella is almost obsolete, but the, here expanded, outer surface of the pleurapophysial lamella shows, above and preaxially, a rough prominent process (*metapophysis*) on the outer surface of the prezygapophysis (there is a rudiment of the metapophysis in the fourth vertebra), and, more ventrally, a very small process near the antero-inferior angle of the lamella on either side. These are *catapophyses*[1] (*c*). The ventral margin of that lamella gives rise at its postaxial end to a short styliform pleurapophysial process (*st*), which seems to answer to the lower of the two superimposed processes of the third vertebra. The higher of the two is much extended and joins the under surface of the postzygapophysis, so bridging over and enclosing a foramen (*f*) visible, on either side, when the vertebra is viewed dorsally. In *P. erithacus* there is no such foramen, though there are two prolongations from the postaxial margin of the pleurapophysial lamella, the more ventral one on more posterior vertebræ (*s*) becoming the styliform pleurapophysial process.

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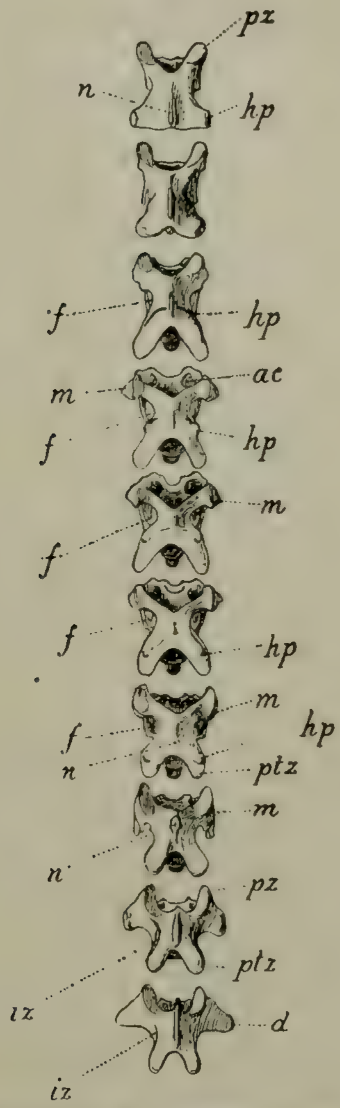
[1] See *op. cit.* p. 401.

Fig. 7.

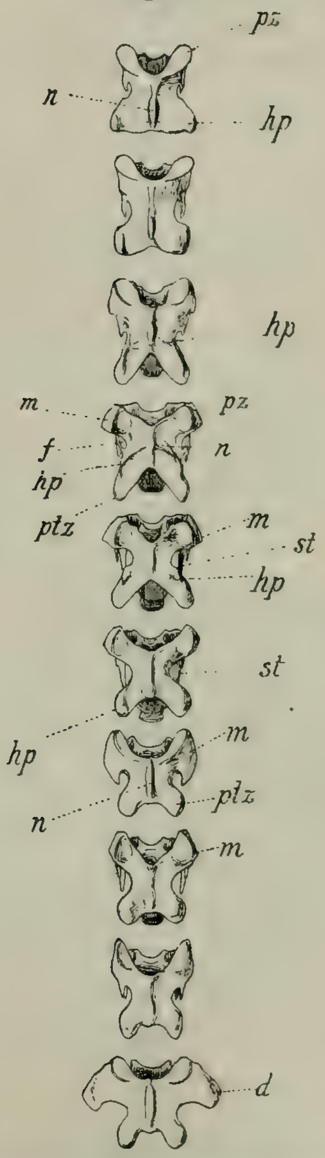


Dorsal aspect of 3rd to 12th vertebræ of *Lorius flavopalliatus.*

ac.	Arterial canal.
d.	Diapophysis.
f.	Foramen.
hp.	Hyperapophysis.
iz.	Interzygapophysial ridge.
m.	Metapophysis.
n.	Neural spine.
ptz.	Postzygapophysis.
pz.	Prezygapophysis.

The *sixth vertebra* of *L. flavopalliatus* has the postzygapophyses (*ptz*) not extending so far backwards as in the preceding bone. The neural spine (*n*) has almost disappeared, but on either side of it the hyperapophyses (*hy*) appear as marked processes which are altogether anterior to the postzygapophyses. The prezygapo-

Fig. 8.



Dorsal aspect of 3rd to 12th vertebræ of *Psittacus erithacus*.

d. Diapophysis.
f. Foramen.
hp. Hyperapophysis.
m. Metapophysis.

n. Neural spine.
ptz. Postzygapophysis.
st. Styliform process.

physes (*pz*) look dorsad, mesiad, and almost slightly postaxiad, and so contrast strongly with those of the fifth vertebra. As they do not extend so much forward, the anterior ends of the lateral arterial canal (*ac*) are visible when the vertebra is viewed dorsally. The hypapophysis has disappeared, but the structure of the pleurapophysial lamella is otherwise much as in the fifth vertebra, save that the foramen (*f*) formed by its superior postaxial process is larger. In *P. erithacus* the conditions are similar, except that the neural spine is not so obsolete. In this species the sixth vertebra is the first and only one to have a lateral foramen (*f*) formed by the process of the pleurapophysial lamella. The catapophyses (*c*) are rather more marked than in the fifth vertebra. In both species the metapophyses (*m*) are prominent.

The *seventh vertebra* of *L. flavopalliatus* is very like the sixth, and the same may be said in the case of *P. erithacus*, except that in the latter species there is no lateral foramen and the pleurapophysial processes (*st*) are longer. In both, the catapophyses (*c*) are more developed than in the preceding vertebra and project preaxiad as well as ventrad. In both, the metapophyses (*m*) are as well developed as before.

The *eighth vertebra* has the catapophyses (*c*) again more prominent and approximated, and they are at their maximum. In *L. flavopalliatus* the hyperapophyses (*hp*) have almost disappeared, and hardly less so in *P. erithacus*. In both they have again receded and stand upon the postzygapophyses.

In the *ninth vertebra* the hypapophysis (*h*) suddenly reappears and is of large size in both species. The neural spine also reappears of considerable size, and is quadrate in shape in *P. erithacus*, but it is only represented by a very low and delicate ridge in *L. flavopalliatus*. In both species the postzygapophyses are shorter and less diverging than in the eighth vertebra. In *L. flavopalliatus* the lateral[1] foramen (*f*) has become slightly smaller. In both species the metapophyses (*m*) are rather more developed and are indeed at their maximum. In *L. flavopalliatus* there are still hyperapophyses (*hp*) on the postzygapophyses.

In the *tenth vertebra* the lateral foramen disappears in *L. flavopalliatus*, and the postaxial margin of the pleurapophysial lamella (*pl*) develops two processes projecting postaxiad and slightly ventrad. The neural spine (*n*) for the first time reappears as a distinct, though smaller pointed process. The postzygapophyses (*ptz*) are smaller than in the preceding vertebra, only projecting about as much backwards as the prezygapophyses do forwards. The hypapophysis (*h*) is much as in the ninth vertebra. In *P. erithacus* it is rather smaller than in the preceding vertebra, slightly bifurcating at its distal end, and the neural spine is certainly smaller. In both species the metapophyses (*m*) are rather smaller.

The *eleventh vertebra* in *L. flavopalliatus* bears a distinct, quadrate neural spine (*n*) and a hypapophysis (*h*) developed much as in the preceding vertebra. Both the pre- and postzygapophyses (*ptz*) project slightly less than in the tenth vertebra, and an antero-posterior external (interzygapophysial) ridge (*iz*) connects them—a trace of which is also to be seen in the tenth vertebra. The neural arch is the shortest, antero-posteriorly, since that of the atlas.

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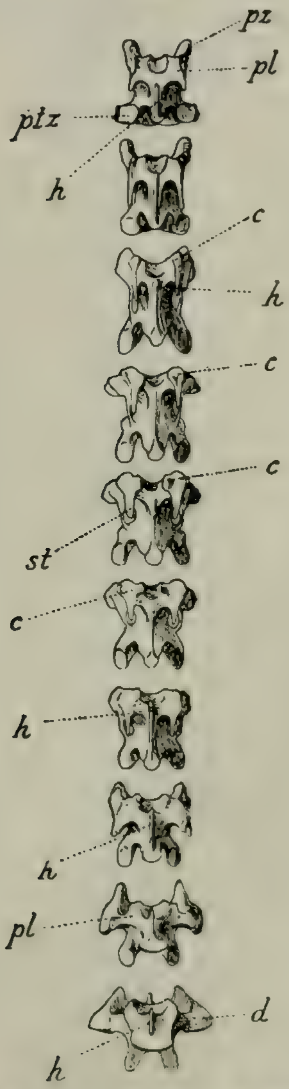
[1] Not the canal enclosed by the pleurapophysial lamella as a whole (that persists on into the eleventh vertebra in both), but only that enclosed by the delicate upper postaxiad process of that lamella.

Fig. 9.

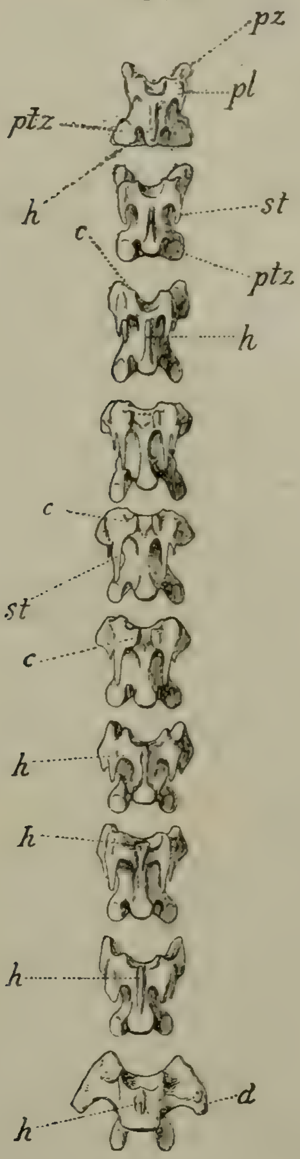


Ventral aspect of 3rd to 12th vertebræ of *Lorius flavopalliatus*.

c. Catapophysis.
d. Diapophysis.
h. Hypapophysis.
pl. Pleurapophysial lamella.
ptz. Postzygapophysis.
pz. Prezygapophysis.
st. Styliform process.

The most striking difference is the reduction in size of the pleurapophysial lamella (*pl*) antero-posteriorly. It has become a delicate ridge of bone, narrower antero-posteriorly than dorso-ventrally. It is antero-posteriorly grooved externally, the groove being

Fig. 10.



Ventral aspect of 3rd to 12th vertebræ of *Psittacus erithacus*.

c. Catapophysis.	*ptz.* Postzygapophysis.
d. Diapophysis.	*pz.* Prezygapophysis.
h. Hypapophysis.	*st.* Styliform lamella.
pl. Pleurapophysial lamella.	

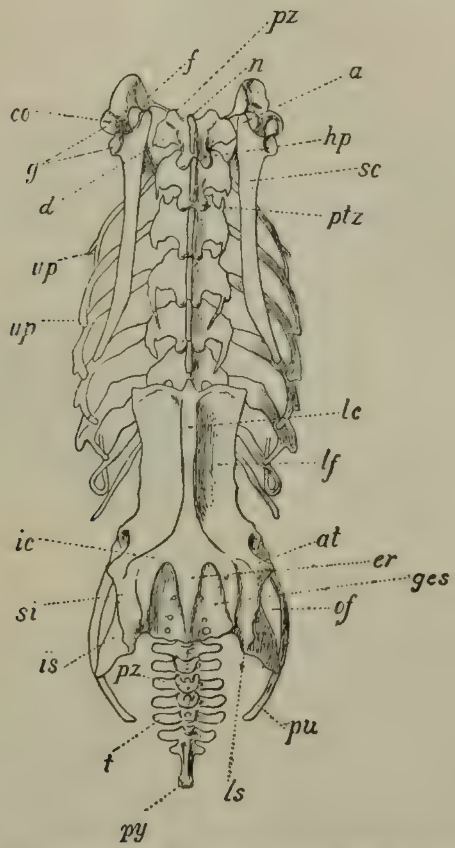
bounded by two ridges, the postaxial end of each of which projects beyond the postaxial margin of the lamella, and correspond with the two similar directed, superimposed, postaxial processes of more anterior cervical vertebræ. In *P. erithacus* the conditions are similar save that the neural spine (*n*) is not so well developed (though slightly more so than in the tenth vertebra), while the pleurapophysial lamella is quite as long antero-posteriorly as in that vertebra, though the styliform, more ventral, process (*st*) projecting postaxiad from its hinder margin is shorter than is that of the same vertebra. The neural arch is not so preeminently shortened antero-posteriorly as in the Lory. In both species the metapophyses are smaller than in the preceding vertebra.

The *twelfth vertebra* of *L. flavopalliatus* (figs. 5, 7, & 9) has the neural arch about as short antero-posteriorly as in the eleventh vertebra, while the pre- and postzygapophyses do not project more, and the interzygapophysial ridges (*iz*) are similarly developed. But the neural spine (*n*) is much more developed than in the eleventh vertebra; it is a high subquadrate process, highest preaxially. The hypapophysis (*h*) is of about the same size as in the eleventh vertebra, but the pleurapophysial lamella altogether makes default. There is a strong transverse process (*diapophysis*) (*d*) which serially corresponds with the ridge bounding dorsally the antero-posterior groove outside the pleurapophysial lamella of the eleventh vertebra—much enlarged. The ventral surface of the centrum is subquadrate in shape, the hypapophysis (*h*) depending from the hinder half of its antero-posterior middle. The ventral surface is bounded laterally by two ridges, the anterior ends of which project preaxiad as two processes one on either side of the preaxial central articular surface. The same two processes exist in the same parts (though to a less marked degree) in the tenth and eleventh vertebræ.

In *P. erithacus* (figs. 6, 8, & 10) this vertebra is similar save that (like the eleventh) it is not so much smaller than more preaxial cervical vertebræ. In both species the metapophyses have here become obsolete.

The *thirteenth vertebra*, in both, is very similar to its serial predecessor save that its neural spine (*n*) is more extended antero-posteriorly, that its hypapophysis is more pointed, that its zygapophyses are smaller, but with some reappearance of hyperapophyses (*hp*), its diapophysis (*d*) more antero-posteriorly wide and presenting a small concave articular surface on its ventral aspect, towards its postero-external angle, for the tuberculum (*tp*) of the first cervical rib, and another (*cp*) for its capitulum on the outer side of the centrum, a little behind the process which projects forwards outside the preaxial central articular surface. This process in *P. erithacus* has here (figs. 13, 14, & 15, pp. 325 & 326) begun to subdivide into two processes connected by a short ridge: one, more dorsal (*x*), on one side of the middle of the central articular surface; the other, more ventral (*c*), at the preaxial end of the ridge bounding laterally the ventral surface of the centrum. These latter processes may be regarded as catapophyses which here make their appearance more. This subdivision accompanies a slight increase in the dorso-ventral perforation of this vertebra compared with that of the preceding one. In *L. flavopalliatus* this subdivision does not take place. The hypapophysis is more quadrate in *P. erithacus*.

Fig. 11.

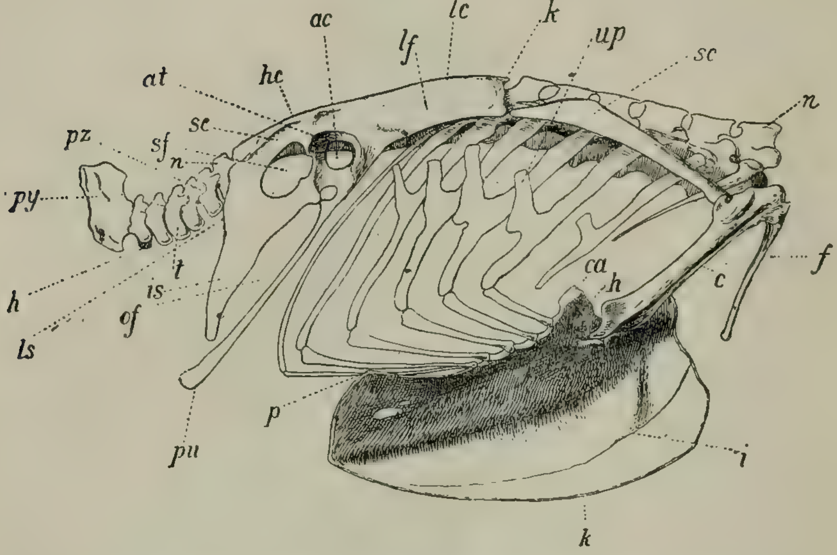


Dorsal aspect of thorax, pelvis, and tail of *Lorius flavopalliatus*.

a.	Acromion.	*lf.*	Iliac fossa.
at.	Antitrochanteric process.	*ls.*	Ilio-caudal spine.
co.	Coracoid.	*n.*	Neural spine.
d.	Diapophysis.	*of.*	Obturator foramen.
er.	Sacral escutcheon.	*ptz.*	Postzygapophysis.
f.	Furculum.	*pu.*	Pubis.
g.	Glenoid surfaces.	*pz.*	Prezygapophysis.
ges.	Groove beside sacral escutcheon.	*py.*	Pygostyle.
hp.	Hyperapophysis.	*sc.*	Scapula.
ic.	Lateral iliac ridge.	*si.*	Sacro-ischiatic ridge.
is.	Ischium.	*t.*	Transverse process.
lc.	Crest of ilium.	*up.*	Uncinate process.

The *fourteenth vertebra* in *L. flavopalliatus* is like its thirteenth save that the neural spine (*n*) is more extended antero-posteriorly. In *P. erithacus* the subdivision spoken of as having taken place in the thirteenth vertebra is here more decided, the catapophyses appearing as processes projecting outwards and forwards from the sides of the hypapophysis (*h*) not much above its ventral end. The catapophyses (*c*), when the vertebra is viewed ventrally, appear as the ends of two ridges diverging preaxiad from the postaxial margin of the hypapophysis (*h*).

Fig. 12.



Lateral aspect of thorax, pelvis, and tail of *Lorius flavopalliatus.*

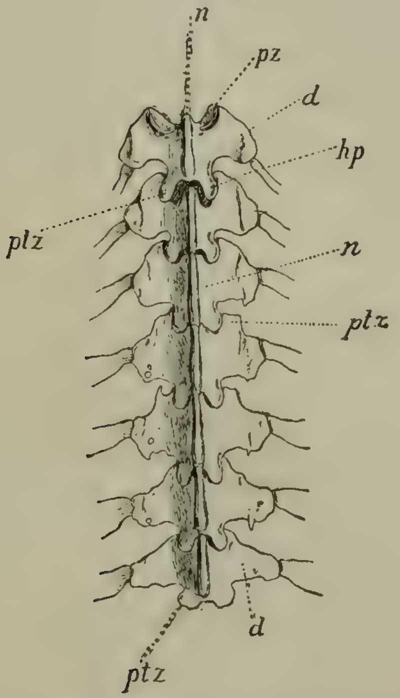
ac.	Acetabulum.
at.	Antitrochanteric process.
c.	Coracoid.
ca.	Costal angle.
f.	Furculum.
h (of tail).	Hypapophysis.
h (of sternum).	Muscular impression.
hc.	Lateral crest.
i.	Intermuscular ridge.
is.	Ischium.
k (of sternum).	Keel.
lc.	Anterior crest of ilium.
lf.	Iliac fossa.
ls.	Ilio-caudal spine.
n.	Neural spine.
of.	Obturator foramen.
p.	Angle of sternum.
pu.	Pubis.
pz.	Prezygapophysis.
py.	Pygostyle.
sc.	Scapula.
sf.	Sacro-sciatic foramen.
up.	Uncinate process.

THE DORSAL VERTEBRÆ.

There are, in *L. flavopalliatus* and *P. erithacus*, four of these vertebræ distinct from the sacral mass.

The *first dorsal vertebra* in *P. erithacus* (figs. 13, 14, & 15) is very like the last cervical, except that the postzygapophyses (*ptz*) are slightly shorter and the transverse process (*t*) slightly more extended antero-posteriorly. The hypapophyses (*hp*) have disappeared, but the hinder end of the summit of the neural spine (*n*) slightly bifurcates and receives between its short processes the preaxial summit of the neural spine behind it. The tubercular and capitular articular surfaces are slightly further apart. The centrum is more laterally compressed and more vertically and also antero-posteriorly extended, the hypapophysis is longer and trifid at its extremity, the two catapophyses having descended nearly to its apex.

Fig. 13.



Dorsal aspect of 13th to 19th vertebræ of *Psittacus erithacus*.

d. Diapophysis.
hp. Hyperapophysis.
n. Neural spine.
ptz. Postzygapophysis.
pz. Prezygapophysis.

In *L. flavopalliatus* the conditions are similar save that the hypapophysis is simple, and that the centrum is not so much more vertically and antero-posteriorly extended than is the last cervical vertebra.

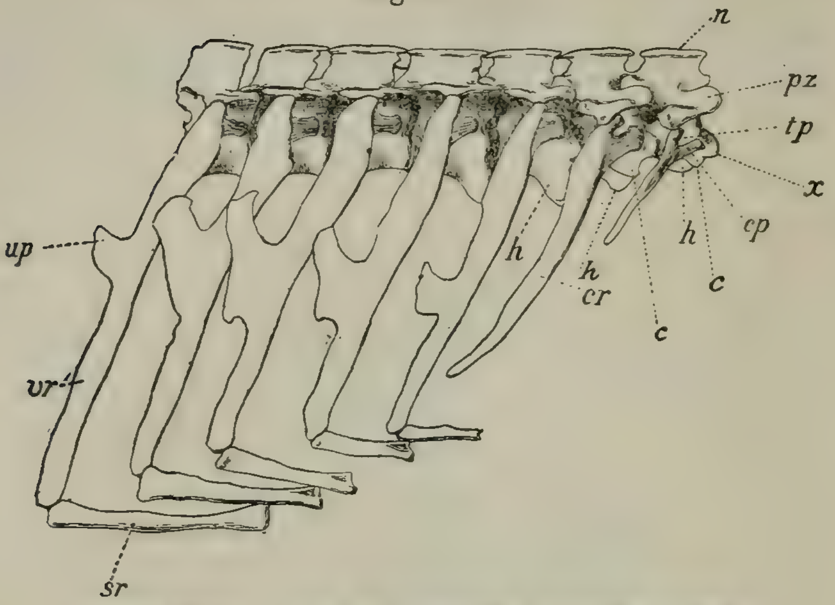
In both species the centrum is extremely narrow transversely. The hinder articular surface of the centrum is concave, but its anterior ventral surface is slightly saddle-shaped in both species.

The *second dorsal vertebra* is very like the first, but the hypapophysis, in *P. erithacus,* ends distally in a hook-shaped pointed process which curves forwards beneath the hinder part of the body of the preceding vertebra. In *L. flavopalliatus* the conditions are generally similar.

The central articular surfaces are convex anteriorly and concave posteriorly.

The *third dorsal vertebra* is very like the second, but the post-

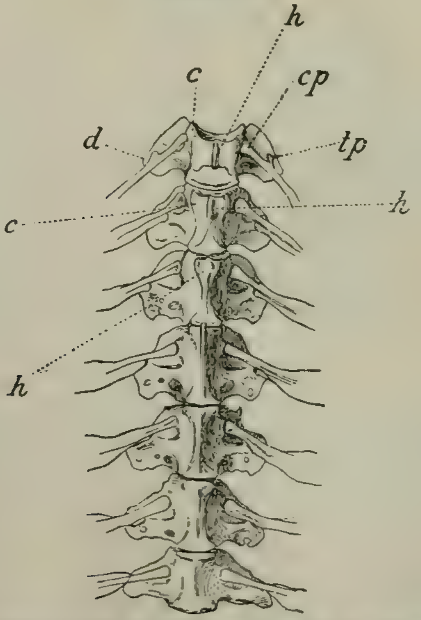
Fig. 14.



Lateral aspect of 13th to 19th vertebræ of *Psittacus erithacus.*

c. Catapophysis.
cp. Capitulum.
cr. Cervical rib.
h. Hypapophysis.
n. Neural spine.
pz. Prezygapophysis.
sr. Sternal rib.
tp. Tuberculum.
up. Uncinate process.
vr. Vertebral rib.
x. Dorsal part of subdivision of catapophysis.

Fig. 15.



Ventral aspect of 13th to 19th vertebræ of *Psittacus erithacus.*

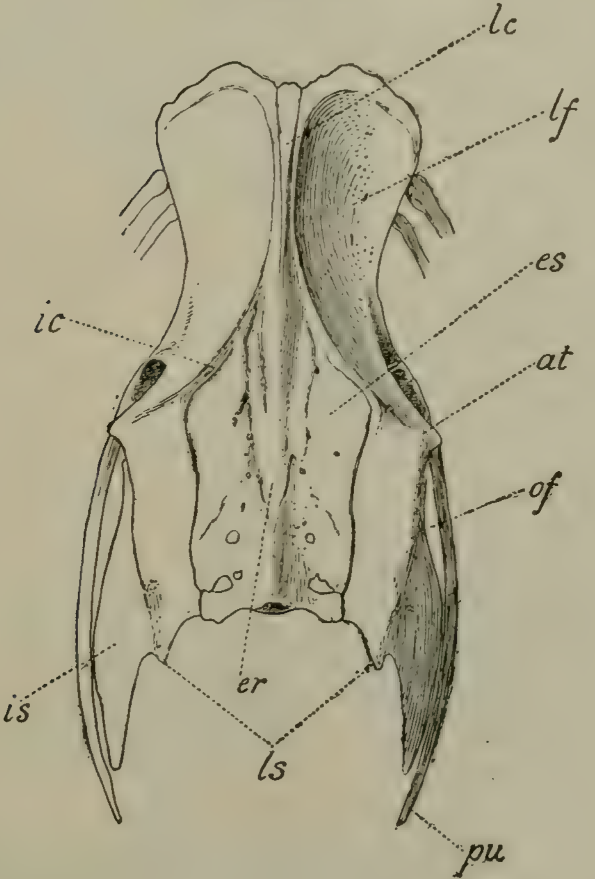
c. Catapophysis.
cp. Capitulum.
d. Diapophysis.
h. Hypapophysis.
tp. Tuberculum.

zygapophyses (*ptz*) are again slightly smaller, the tubercular and capitular perhaps rather farther apart. There is no hypapophysis. The centrum is not quite so narrow transversely as it is in the first and second dorsal vertebræ. The articular surfaces of the centrum are again slightly convex in front and decidedly concave behind in both species.

The *fourth dorsal vertebra* is very like the third save that its centrum is slightly shorter antero-posteriorly and not quite so compressed laterally, and that the summit of the neural spine ceases to bifurcate at its hinder end. The centrum is again convex anteriorly and concave posteriorly.

The *fifth dorsal vertebra* has its centrum again somewhat shorter and less laterally compressed, and the articular surfaces for the

Fig. 16.



Dorsal aspect of sacrum and pelvis of *Psittacus erithacus*.

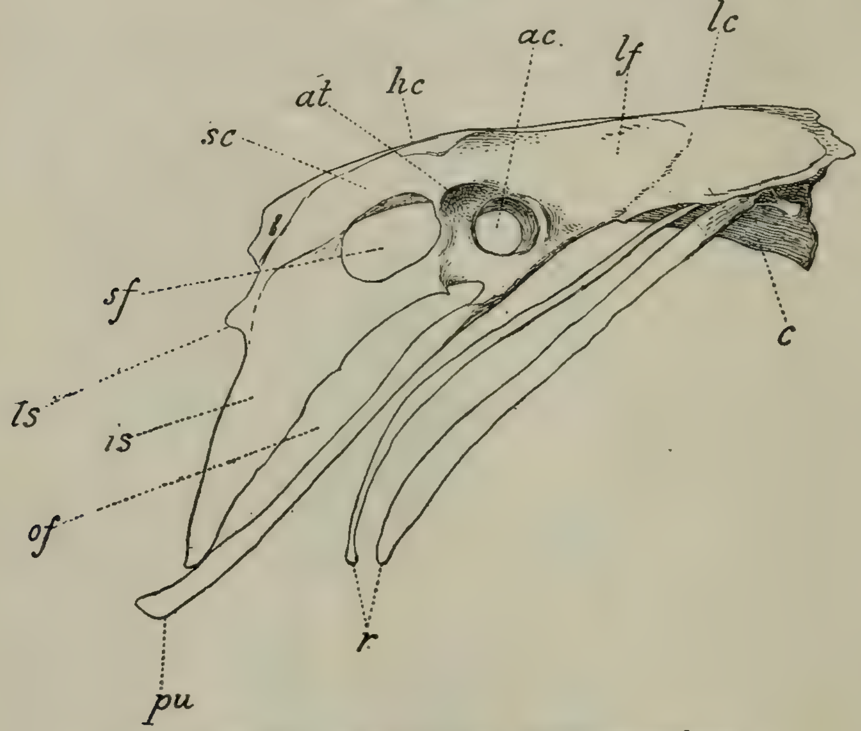
at.	Antitrochanteric process.
er.	Median part of sacral escutcheon.
es.	Lateral part of the same.
ic.	Lateral iliac ridge.
is.	Ischium.
lc.	Iliac crest.
lf.	Iliac fossa.
ls.	Ilio-caudal spine.
of.	Obturator foramen.
pu.	Pubis.

tuberculum and capitulum not quite so far apart. The posterior articular surface of the centrum is concave.

THE SACRUM.

This mass of anchylosed vertebræ (figs. 16, 17, 18, & 19) apparently consists in both species of four *lumbo-sacral vertebræ*, an indeterminable number of *sacral* vertebræ, and from five to six, probably seven, *uro-sacral* vertebræ.

Fig. 17.



Lateral aspect of sacrum and pelvis of *Psittacus erithacus*.

ac.	Acetabulum.	*ls.*	Ilio-caudal spine.
at.	Antitrochanteric process.	*of.*	Obturator foramen.
c.	Lumbo-sacral vertebra.	*pu.*	Pubis.
hc.	Lateral crest of ilium.	*r.*	Sacral ribs.
lc.	Crest of ilium.	*sc.*	Posterior part of ilium.
lf.	Iliac fossa.	*sf.*	Sacro-sciatic foramen.

THE LUMBO-SACRAL VERTEBRÆ.

These four vertebræ are anchylosed together with the ilium (*il*), and, of course, with the solid mass of the true sacral vertebræ.

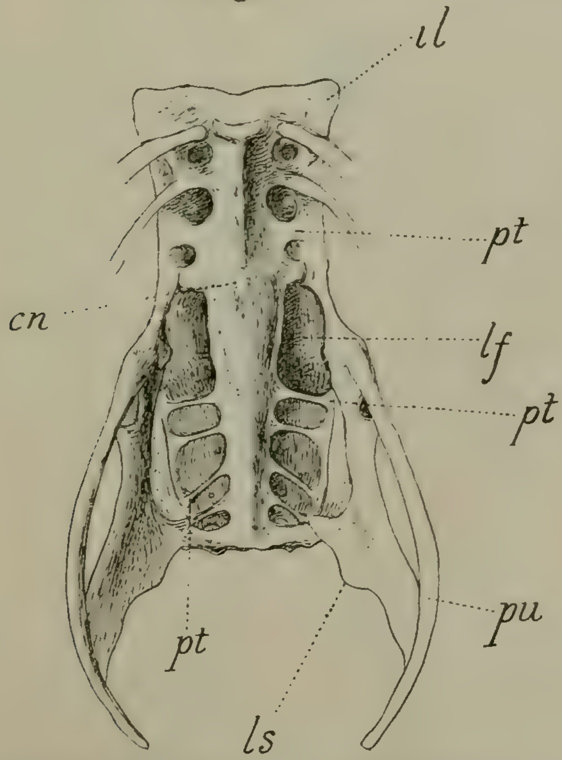
The *first lumbo-sacral* vertebra seen preaxially exhibits its neural arch, prezygapophyses, neural spine, and transverse processes, each presenting a concave tubercular surface, while outside the base of the neural arch just above the centrum is the capitular cup. The preaxial surface of the centrum is concave.

The *second lumbo-sacral* vertebra is indistinguishable save for its parapophysial transverse process (*pt*) and thereto anchylosed long ribs, between which and the transverse process of the preceding vertebra a fossa appears. Thus, when the ventral surface of the sacrum is looked at, a fossa appears on either side between the two transverse processes of the preceding and those of the present vertebra.

The *third lumbo-sacral* vertebra in *Lorius flavopalliatus* bears no rib but only a short parapophysial transverse process on either side (*pt*), which anchyloses distally with the ilium and is slightly more antero-posteriorly extended than that of the preceding vertebra. Between these two transverse processes and those of the second lumbo-sacral vertebra a fossa is to be seen (on the ventral aspect of the sacrum) on either side, of about the same size as those between the transverse processes of the first and second lumbo-sacral vertebræ. The transverse diameter of the centrum is slightly wider than that of the preceding vertebra.

The *fourth lumbo-sacral* vertebra is quite similar to the preceding one in *L. flavopalliatus*, but in *P. erithacus* its transverse process

Fig. 18.



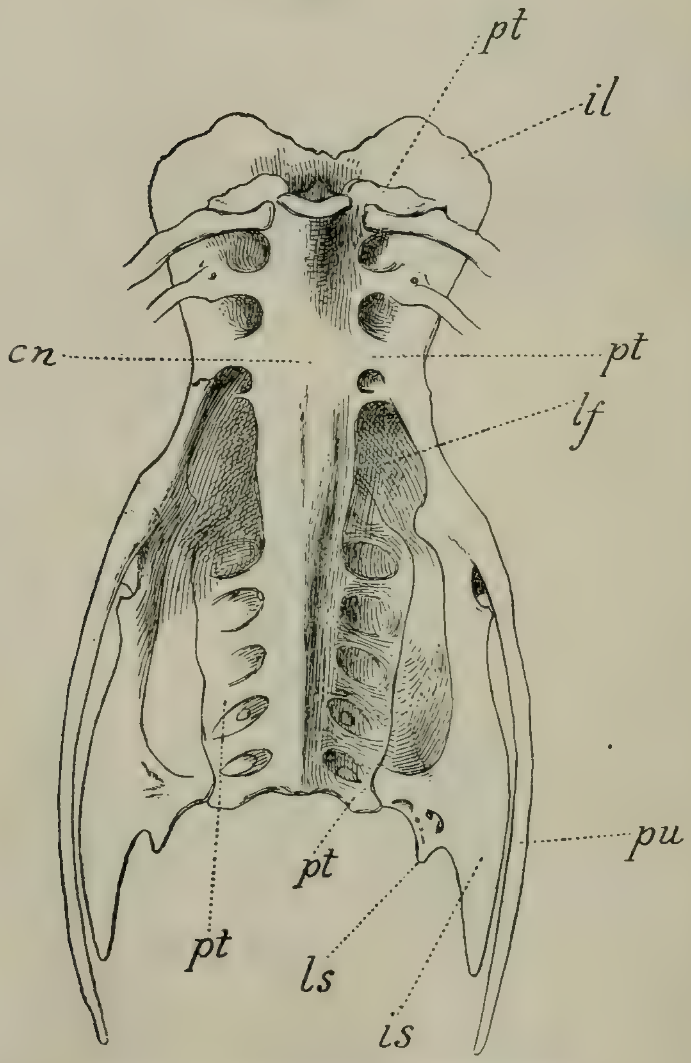
Ventral aspect of sacrum of *Lorius flavopalliatus*.

cn. Fused sacral vertebræ.
il. Ilium.
lf. Lateral fossa.
ls. Ilio-caudal spine.
pt. Parapophysial process.
pu. Pubis.

is more slender than its serial predecessor. The fossa between it and that of the third lumbo-sacral vertebra is smaller than those between the transverse processes of the preceding vertebræ, but the difference is not so great in *L. flavopalliatus* as in *P. erithacus*. The centrum is again slightly wider than that of its preceding vertebra.

The ventral surface of the lumbo-sacral vertebræ is somewhat keeled, ridge-like, in *L. flavopalliatus*, but not so in *P. erithacus* (*cn*).

Fig. 19.



Ventral aspect of sacrum of *Psittacus erithacus*.

cn. Fused sacral vertebræ.
il. Ilium.
is. Ischium.
lf. Lateral fossa.
ls. Ilio-caudal spine.
pt. Parapophysial process.
pu. Pubis.

THE SACRAL VERTEBRÆ.

The solid mass formed by these vertebræ (figs. 18 & 19) is longer than broad and narrows gently backwards. Its ventral surface is slightly grooved antero-posteriorly in its middle. It develops no parapophysial transverse processes, and so a large long fossa (*lf*) lies on either side of it, roofed by the ilium and bounded in front by the parapophysial transverse process of the last lumbo-sacral vertebra and behind by the transverse process of the first uro-sacral vertebra. Rudiments of diapophysial portions of transverse processes appear to coalesce with the ventral surface of the ilium of this region.

THE URO-SACRAL VERTEBRÆ.

These vertebræ (figs. 16, 18, & 19) continue on postaxially the sacral mass, narrowing gradually as they proceed. It develops a series of parapophysial transverse processes (*pt*), six at least on each side, which extend outwards, backwards, and slightly upwards, anchylosing with the ischium at their apices. They anchylose with it also for more or less, or for the whole, of their extent in *P. erithacus*. The diapophysial elements of the transverse processes are widely extended antero-posteriorly, and unite so as to form the dorsal sacral escutcheon (*es*), which is a continuous sheet of bone save for the sacral foramina, which indicate the limits of the diapophysial transverse processes—interposed between the hinder halves of the two ilia and the two ischia. In *L. flavopalliatus* each of the transverse processes on either side of the first uro-sacral vertebra is quite separate from the ischium above it till close to the apex of the transverse process, when it anchyloses therewith. Its dorsal sacral escutcheon also is almost entirely postaxial to the acetabula instead of extending in front of them as in *P. erithacus*, and presents on either side a marked antero-posterior groove (*ges*), widening backwards from its apex, which is placed in a line nearly coincident with the hinder margin of the acetabulum. These two grooves are separated by a strongly-marked antero-posteriorly extending ridge (narrowing postaxiad), which is only faintly indicated in *P. erithacus*.

THE CAUDAL VERTEBRÆ.

There are six caudal vertebræ in *L. flavopalliatus* (fig. 12, p. 324), with variously developed neural spines, zygapophyses, transverse processes (*t*), and hypapophyses.

The *first three caudal* vertebræ have transverse processes (*t*) which are simple, flattened above and below, and slightly increase in length from the first to the fourth caudal vertebra. Those of the first are about as long as those of the last uro-sacral vertebra. The prezygapophyses (*pz*) of the first of these vertebræ extend but very slightly forward, those of the other two extend preaxiad more and more.

The *first caudal* vertebra has a small, quadrate, low, neural spine (*n*) and two prezygapophyses which extend but very slightly forwards, while the postzygapophyses are very small indeed. The transverse processes are simple, flattened above and below, and about as long as those of the last uro-sacral vertebra. The ventral surface of the centrum presents at its ventral margin two blunt hypapophysial processes, which abut against the postero-inferior margin of the sacrum.

The *second caudal* vertebra is similar to the last except that the neural spine is not so quadrate (being highest preaxially), the prezygapophyses (*pz*) are slightly larger, the postzygapophyses more developed, while small hyperapophyses reappear upon them. The transverse processes (*t*) are slightly longer, while the two hypapophysial processes are clearly approximated and project slightly more preaxiad.

The *third caudal* vertebra has again the same characters carried slightly further, while the hypapophysis has become single and projects slightly forward beneath, and applied to, the ventral surface of the second caudal.

The *fourth caudal* vertebra has its neural spine and prezygapophyses inclined strongly preaxiad, the hyperapophyses slightly larger and the transverse processes slightly longer (both are here at their maximum in the caudal region), while the hypapophysis is a little more developed, ventrally grooved antero-posteriorly, and tending to bifurcate at the apex, and developed, as before, from the preaxial end of the centrum.

The *fifth caudal* vertebra has its transverse processes slightly shorter, the neural spine less inclined preaxiad, and hyperapophyses much smaller and more preaxially placed. The hypapophysis is long, situated at the preaxial margin of the centrum, and bifurcates distally.

The *sixth caudal* vertebra has all its parts and processes diminished save the hypapophysis (*h*), which is somewhat longer and stouter, still less inclined preaxiad, but still distally bifurcating into two lateral processes diverging slightly more than those of the fifth caudal vertebra.

THE PYGOSTYLE.

The pygostyle in *L. flavopalliatus* (*py*, fig. 12, p. 324) is a laterally much compressed subquadrate plate of bone with anterior, superior, and posterior margins, while inferiorly it carries on, as it were, the series of caudal vertebræ. At its preaxial end below are minute transverse processes and prezygapophyses, which latter adjoin the corresponding parts of the last caudal vertebra.

From its ventral surface a process depends which is in series with the hypapophyses in front.

The preaxial margin of the plate is strongly concave, the postaxial margin slightly so. The former margin is entirely thin, but the posterior one is medianly thin but thickened, though flattened, below and more so dorsally. The superior margin of the plate is in the form of a thin crest convex medianly and bifurcating laterally at its postaxial end (*py*), at the dorsal margin of the upper flattened part of the hinder margin.

In *P. erithacus* the pygostyle is essentially similar, save that it is a triangular rather than a quadrate plate. It would resemble that of *L. flavopalliatus* if from the latter all was cut off preaxial to a line passing from the superior extremity of its hinder margin obliquely downwards and forwards to a point between the prezygapophyses.

THE RIBS.

There are eight or nine dorsal and five ventral ribs on each side (figs. 12 & 14).

The Dorsal Ribs.

In both species there are two cervical ribs and six or seven true thoracic ribs, whereof five are articulating with the sternum, while one or two are floating ribs.

The Cervical Ribs.

The *first cervical* rib is, in both species, long, slender, styliform, and devoid of any uncinate process. The tubercular and capitular processes are of about equal length.

The *second cervical* rib is about one-third longer than the first and generally bears an uncinate process (*up*). If so this is short and does not expand dorso-ventrally at its distal end. The capitular process is somewhat longer than the tubercular one.

The Thoracic Ribs.

The *first thoracic* rib is a little longer and stouter than the second cervical, and its uncinate process (*up*) expands distally into a short ventrad and longer dorsad and postaxiad process, so it is much longer dorso-ventrally than antero-posteriorly.

The *second thoracic* rib is again slightly longer, while its uncinate process has a longer dorsal process and a shorter ventral margin. The tuberculum is slightly more distant from the capitulum than in the first true rib.

The *third thoracic* rib carries a little further the same modifications, save that the uncinate process in *L. flavopalliatus* loses entirely the quadrate shape and is subtriangular with a truncated apex. Its distance from the distal end of the rib is also greater. It may still be subquadrate in form in *P. erithacus*.

The *fourth thoracic* rib has in the last-named species a much smaller and simply shaped uncinate process, which is still further removed from the rib's apex.

L. flavopalliatus differs from *P. erithacus* in that all the ribs are more slender (relatively as well as absolutely), while the uncinate processes are relatively longer and more slender, notably that of the fourth true rib.

The *fifth thoracic* rib is more slender, and is very slender in *L. flavopalliatus,* in which it bears no uncinate process. It may bear a small and simple one in *P. erithacus.*

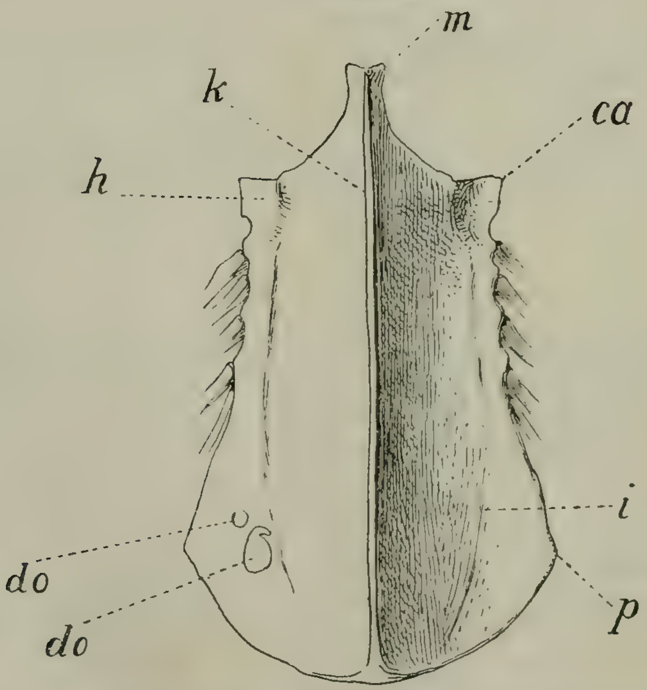
The sixth thoracic or *first floating rib* is longer than the fifth true rib, and still more slender, and is more or less anchylosed to the sacrum.

No seventh thoracic or *second floating rib* is developed in *L. flavopalliatus,* but may be present in *P. erithacus.* Then it is long, very slender, and anchyloses with the sacrum.

The Sternal Ribs.

There are five sternal ribs (figs. 12 & 14, pp. 324, 326) on each side which articulate dorsally with the respective apices of the thoracic ribs and ventrally with the sternum. The last three are expanded dorso-ventrally at their proximal ends. They are expanded transversely at their distal ends; each presenting there a surface some-

Fig. 20.



Ventral aspect of sternum of *Lorius flavopalliatus.*

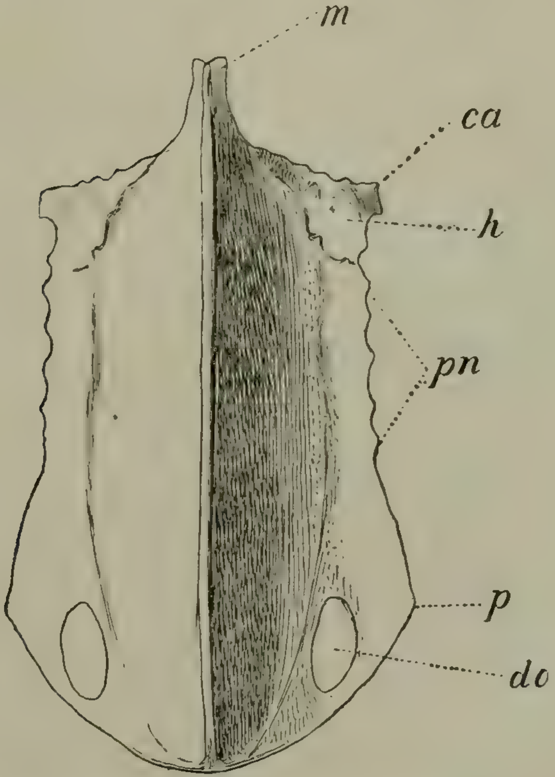
ca. Costal angle.
do. Defect of ossification.
h. Muscular impression.
i. Intermuscular ridge.
k. Keel.
m. Manubrium.
p. Lateral angle.

what hourglass-shaped, with two slight concavities to articulate with corresponding slight convexities on the pleurosteon (*plu*) of the sternum.

They increase rapidly in length from the first to the fifth; they are also somewhat longer, relatively, in *L. flavopalliatus* than in *P. erithacus*, especially the first on either side.

In *P. erithacus* it is shorter than the distance from the apex of the first thoracic rib to the ventral margin of the uncinate process. In *L. flavopalliatus* it is longer than that distance, and the same is the case as regards the three following sternal ribs in that species. In *P. erithacus* the three following ones about equal the length of their corresponding thoracic rib, from its apex to the ventral margin of the uncinate process.

Fig. 21.

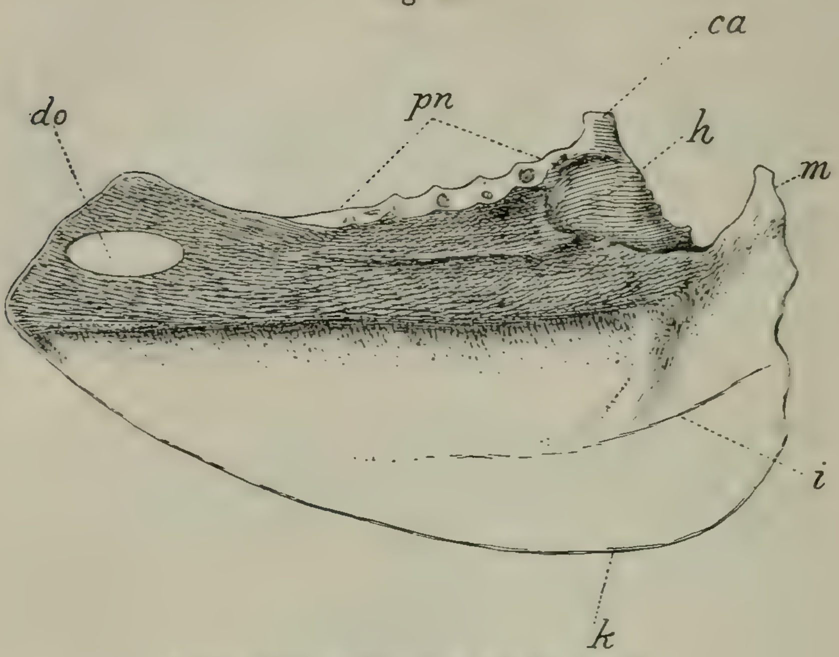


Ventral aspect of sternum of *Psittacus erithacus*.

ca. Costal angle.
do. Defect of ossification.
h. Muscular impression.
m. Manubrium.
p. Lateral angle.
pn. Pleurosteon.

The sternal rib corresponding with the first floating thoracic rib does not articulate with the sternum, but rather applies itself to the postaxial surface of the fifth sternal rib near to its distal end.

Fig. 22.



Lateral aspect of sternum of *Psittacus erithacus.*

ca. Costal angle.	*k.* Keel.
do. Defect of ossification.	*m.* Manubrium.
h. Muscular impression.	*pn.* Pleurosteon.
i. Intermuscular ridge.	

THE STERNUM.

The sternum (figs. 20, 21, & 22) has, in both species, the simple form so common in the Parrots. The only differences I have remarked are that in *L. flavopalliatus* the keel (*k*) projects preaxiad decidedly in front of the manubrium (*m*); the intermuscular ridge (*i*) on the side of the ventral surface of the sternum is slightly nearer to the pleurosteon; the lateral margin behind the attachment of the fifth sternal rib exceeds the length of the pleurosteon measured from that point to the posterior margin of the attachment of the first sternal rib. The surface of the sternum is also more entire, the costal angle (*ca*) extends less dorsad relatively, while its summit is antero-posteriorly broadened and the manubrium is differently shaped. In *P. erithacus* it appears (*m*) rather pointed towards its apex when viewed laterally. The anterior surface presents a long vertical groove gradually tapering ventrad; above this, a hardly noticeable tendency to bifurcation may be detected. Posteriorly it is transversely convex and not at all grooved longitudinally. Its anterior margin, below the anterior groove, is concave preaxiad, while its posterior margin is concave postaxiad.

The internal surface of the sternum presents at its preaxial end two strongly marked transverse prominences just behind and corresponding with the dorsal margins of the coracoid grooves. From their median junction a less strongly marked ridge runs a short distance postaxiad, a marked fossa existing on either side of it and behind the transverse prominences. Numerous small foramina open round the margins of these fossæ and thence backwards over a considerable part of the internal surface of the sternum. In both species the pleurosteon has six excavations divided by five septa, each of which bears two superimposed convexities for one of the sternal ribs.

In *L. flavopalliatus* the manubrium, when laterally viewed, appears less elongated and less pointed towards its apex. Its anterior surface presents a rounded cup, in the place of an elongated groove, but the tendency to lateral bifurcation is rather more marked. The anterior margin, below the anterior cup, is convex preaxiad.

The internal surface of the sternum has only faint lateral ridges coinciding with the dorsal margins of the coracoid grooves, and there is no postaxiad median ridge, but in its place a large foramen leading into the substance of the bone.

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PHILIP LUTLEY SCLATER, M.A., Ph.D., F.R.S.,
Secretary.

3 Hanover Square, London, W.,
October, 1895.

corresponding with the dorsal margins of the coracoid grooves. From their median junction a less strongly marked ridge runs a short distance postaxiad, a marked fossa existing on either side of it and behind the transverse prominences. Numerous small foramina open round the margins of these fossæ and thence backwards over a considerable part of the internal surface of the sternum. In both species the pleurosteon has six excavations divided by five septa, each of which bears two superimposed convexities for one of the sternal ribs.

In *L. flavopalliatus* the manubrium, when laterally viewed, appears less elongated and less pointed towards its apex. Its anterior surface presents a rounded cup, in the place of an elongated groove, but the tendency to lateral bifurcation is rather more marked. The anterior margin, below the anterior cup, is convex preaxiad.

The internal surface of the sternum has only faint lateral ridges coinciding with the dorsal margins of the coracoid grooves, and there is no postaxiad median ridge, but in its place a large foramen leading into the substance of the bone.

May 7, 1895.

Sir W. H. Flower, K.C.B., LL.D., F.R.S., President,
in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of April 1895:—

The total number of registered additions to the Society's Menagerie during the month of April was 73, of which 42 were by presentation, 6 by birth, 4 by purchase, 1 by exchange, and 20 on deposit. The total number of departures during the same period, by death and removals, was 124.

Special attention may be called to the following acquisitions:—

1. Two specimens of the newly described Irish Stoat (*Putorius hibernicus*) from Wicklow, presented by Viscount Powerscourt, F.Z.S. It has been recently shown (see 'Ann. & Mag. Nat. Hist.' ser. 6, xv. p. 374 (1895), and 'Zoologist,' 1895, p. 124) that the Irish Stoat is a smaller form of the Stoat of Great Britain and requires to be specifically isolated. I exhibit one of the living specimens.

2. Two Mountain Hares (*Lepus variabilis*) from Norway, presented by Mr. O. Gude, April 18th.

3. Three specimens of the peculiar Parrakeet of the Antipodes Islands (*Cyanorhamphus unicolor*), one presented by Sir Walter E. Buller, K.C.M.G., C.M.Z.S., one by W. E. Collins, Esq., and one by the Countess of Glasgow. At the time of the completion of

Count Salvadori's Catalogue of Parrots (see 'Catalogue of Birds in the British Museum,' vol. xx. p. 581) there was but a single specimen of this Parrakeet in the British Museum. The recent voyage of the Earl of Glasgow, Governor of New Zealand, in the 'Hinemoa,' to the outlying islands of New Zealand, has resulted in the acquisition of several specimens of this rare species.

I take this opportunity also of calling attention to the specimens of the Pacific Rat (*Mus exulans*) obtained by the Governor of New Zealand during his recent visit to Sunday Island, Kermadec group, and received March 14, 1895, and presented by the Countess of Glasgow. I exhibit a living pair of this interesting Rat, concerning which Mr. O. Thomas has favoured me with the following note:—

"PACIFIC RAT (*Mus exulans*).

"The Rats from Sunday Island, Kermadec group, apparently belong to a species widely spread over the Pacific, the earliest name of which seems to be *Mus exulans*, Peale[1], based on Fijian examples. It is possible that examples from the different groups of islands may hereafter show certain differences from each other, but, so far as we can see at present, all should be united under one heading. Indeed the fine Maori Rat of New Zealand (*Mus maorium*, Hutton[2]) seems to be very doubtfully separable from the same form, which has probably travelled from island to island in native canoes, or on floating logs &c., long before European ships began to bring over the ubiquitous Grey and Black Rats, which now threaten to exterminate the native species throughout the world."

The following extract from a letter addressed to the Secretary by Dr. Jentink, dated Leiden, April 30th, 1895, was read:—

"There is in the 'Zoologische Garten,' 1890, pp. 266–269, a paper written by Dr. Oudemans, concerning a living Monkey that Dr. Oudemans described as a new species under the specific title *Cercopithecus aterrimus*. In this paper Dr. Oudemans states that '*ausgemacht wurde der Affe sei wirklich eine neue Art.*' I feel obliged to state that the story is not quite correctly told by Dr. Oudemans, for, when he showed me his Monkey, and after I had compared it with the large series in our Museum, I informed him that if the animal was an adult specimen it might belong to an undescribed species; however, if it was a young one I thought it would belong to *Cercocebus albigena*. We could not make out whether all the molars were present or not, as the animal would not allow us to examine its dentition.

"Shortly afterwards it died, and I purchased the cadaver. It was then manifest that it was indeed a young specimen, having the molars still undeveloped, and that it was really a young *Cercocebus albigena*. And under that name I have registered it in my 'Catalogue systématique des Mammifères,' 1892, p. 26.

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[1] Peale, U.S. Exploring Exped., Mamm. p. 47 (1848).

[2] Trans. N. Z. Inst. x. p. 288 (1878).

"The reason why I write you the above is that I read (P. Z. S. 1894, p. 594) that you were unable to say whether a living Monkey in your Gardens from British Central Africa should be referred to *C. albigena*, to *C. aterrimus*, Oudemans, or to a new species. I think that your specimen is either a new species or (as *C. albigena*=*C. aterrimus*) perhaps a young *C. albigena*"[1].

Mr. J. H. Gurney, F.Z.S., exhibited and made remarks on an example of *Alcedo beavani* obtained in Ceylon by Mr. A. L. Butler.

Mr. G. F. Scott Elliot, M.A., F.L.S., F.R.G.S., gave an account of some of the principal animals that he had collected and noticed during his recent expedition to Mount Ruwenzori, in British Central Africa. Mr. Scott Elliot's remarks were as follows:—

The object of my expedition was almost wholly botanical, and I must begin by stating frankly that I have no right whatever to call myself either a zoologist or a sportsman. During my whole expedition I was entirely alone, and I had neither sufficient alcohol nor traps to make extensive collections. Therefore I hope that you will pardon the crudeness and insufficiency of what I have to say.

The most important animal on Ruwenzori is, of course, the Elephant (*Elephas africanus*). On Ruwenzori itself the Elephant is almost always to be seen between a spot called Chukarongo on the eastern side and a few miles south of Kasagamas. On one occasion I saw a hundred together, but usually they go about in small herds of from three to seven or eight in number. They ascend the Nyamwamba and Mubuka valley to about 5600 feet, but not higher, more, I think, on account of the steepness of the mountain-sides above this level than for any other reason. They also occur on the Nyamgassu River, which enters the Albert Edward beyond the Salt Lake, but not, so far as I could tell, on the west side of Ruwenzori; though they are said to be in great abundance on the other side of the Semliki River—which is part of the rich ivory country belonging to the Wanyuema which seems to extend down to at least 5° S. lat.

A short time before my arrival a party of Wanyuema had called at the Salt Lake to ask if they might settle and send their ivory to the coast, *viâ* Uganda. Unfortunately, no European was there, and before any reply could be sent from Uganda the trader, Mr. Stokes, with an enormous caravan, passed up the west bank of the Semliki and probably carried off all the ivory there. It will be thus seen that there are two sources of supply about the Albert Edward Nyanza, namely the Wanyuema country and that about the east side of Ruwenzori. An organized transport to the Victoria Nyanza and by boat across the lake would enable the Government to obtain the ivory from both these districts.

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[1] [Our specimen of this rare Monkey is since dead, and the skin and skull have been deposited in the British Museum. I agree with Dr. Jentink that it is probably not different from *C. albigena*.—P. L. S.]

It may perhaps interest you to hear what is the present distribution of Elephants in East Central Africa.

I first came across their traces in the Mau Forest, where they seemed to ascend to at least 6000 feet. I understand they still exist within two days' journey of Kikuyu to the North-west, and probably from there to Kenia and by Elgon and the Somerset Nile to the Albert Nyanza and Unyoro generally. There are probably considerable numbers in Sotik to the east of my route. They seem to be absent from Buddu and Uganda proper, though in Chagwe, four days from Kampala, some are said to exist. They are probably quite extinct in Ankole, Karagwe, and Mpororo, though there are a few east of Albert Edward Nyanza. There are, however, plenty in Kivari and on the east of Ruwenzori.

There are none along the eastern shore of Tanganyika, and I very much doubt if any are left in the whole of the German sphere of influence, except perhaps about Kilima-njaro.

There are still some herds about the Lake Moero and the western border of British Central Africa, but I fancy they will very soon be exterminated in the Elephant Marsh and Milanje districts.

Hence when the accumulated stores of generations of native chiefs have been exhausted, the supply will enormously diminish.

The Hippopotamus (*H. amphibius*) seems to be rare on the Albert Edward, though it undoubtedly does exist about Kuliafiris. I have also seen the skull of one a long way up the Mubuku valley, where it may have been carried. On the Kagera River their abundance is almost incredible. I do not think I have ever seen 200 yards of the river without hearing or seeing one. The natives call this animal 'ufufu,' which exactly represents its sound. The river flows through strips of papyrus, and the alluvial banks, which are usually 30 feet higher than the level of the river, seem to support plenty of a kind of *Andropogon* grass, of which they are very fond.

The Rhinoceros (*Rhinoceros bicornis*) is more abundant about the marshy lakes of Karagwe than on any other part of my journey. On one day I came across them five times, but, unfortunately, failed to get one.

The Antelopes about Ruwenzori are not very numerous. There are first the ubiquitous Hartebeest (*Bubalis jacksoni* ?), two species of *Kobus*, and at least two Gazelles, one of which appeared to be very like *Gazella thomsoni* of the Masai plains. These Antelopes occur on the wide grassy alluvial plains and low hills under 5000 feet along the eastern side: they are, I think, very rare on the west. They seem to shift their position constantly, owing to the condition of the grass. In April I found quantities of all sorts near

Butanuka, where the grass was about 4 or 5 inches long, and just growing. Passing back over this country in June, when the grass was two feet high and in a dry and withered condition, I saw scarcely any except on places where there had been a fire and young grass was springing up. They probably had gone off to the immediate neighbourhood of the lake. I thought this important, in view of the possibility of cattle-ranching at this point. The Hartebeest, I fancy, is the same which I saw in Buddu and on the Nandi range, probably Jackson's. The Kob (*Cobus kob*), of which I obtained horns, seems pretty common near the Albert Edward. Another Waterbuck, which may have been the Sing Sing (*Cobus unctuosus*), is not uncommon. It has the hair and reddish colour of the Sing Sing, but seemed to me a larger animal and with much larger and broader hoofs than the Sing Sing. Unfortunately, I did not think it worth while to bring home a skin.

In the forest on the Wimi valley, at about 8000 feet, I saw a Bushbuck which I failed to get. This was not the *Cephalophus æquatorialis* (of which I brought the skin and skull from the Victoria Nyanza), nor could it have been the Abyssinian species. It was a very distinctly reddish or bright bay, very much like *Cephalophus natalensis* according to the description.

There are several species of Monkey about Ruwenzori. One of these is a *Colobus*, but I have not been able to identify it. It has the long white and black fur of the *Colobus guereza*, but it is not that species. It might be either *C. caudatus* of Kilima-njaro, or *C. angolensis*, but it seems to me different from the figures of both of them. It is most common in the Yeria and Msonje valleys near Butanuka, but I could not get a specimen. It has a very curious weird screaming cry, quite unlike that of any other animal.

I brought home a specimen of *Cercopithecus pluto* or of the allied form *C. stuhlmanni*. The Wakondja in the Nyamwamba valley, East Ruwenzori, make a sort of pouch or pocket of its skin, which they carry over the shoulder, so that the animal must be common. This Monkey is extremely shy, and usually the only sign of its presence is the noise of a tremendous crash amongst the branches a long distance away. Once I saw very well a troop of another monkey, probably a *Cercopithecus* also. I was alone, of course without a gun, and sitting down very quietly on a fallen tree. Four or five of the older males came quite close after some hesitation. They had white marks on the face, simulating eyebrows, moustache and imperial, and their expression was melancholy and unhappy.

There are also Baboons (*Papio*, sp. inc.) on the Wimi River, where they greatly damage the native crops.

A kind of Lemur (probably a *Galago*), a nocturnal creature living in hollow trees, was the only animal I heard of on the west side of the mountain.

A Squirrel (*Sciurus rufo-brachiatus*) of West-African affinity is common in the Wini valley.

I found amongst the smaller mammals an *Arvicanthis*, allied to *A. abyssinicus*, Rüpp., *Georychus ochraceo-cinereus* of Heuglin, a *Dendromys* allied to *D. mystacalis* of Heuglin, a *Mus* allied to *M. lateralis*, Heuglin. I have to thank Mr. Oldfield Thomas for naming these Rodents and for other kind assistance.

Leopards are very common and a terrible scourge in the eastern valleys of Ruwenzori. In some cases the natives keep within their bomas after 3 P.M. on account of them. One very dark evening two of my men were very severely hurt by them. The animal, after tasting the blood of one of them, leaped in amongst the camp-fires and seized a second.

Lions are also common in the lower ground about Kasagamas. They hide in the neighbourhood of the plantations and carry off the women or solitary men when they come to work.

With regard to birds, I have only brought a few specimens. Of these there are two species of *Nectarinia*. One of them (*N. kilimensis*) is found amongst the bananas at from 5500 to 6600 feet in the valleys along the mountain. It seems to feed entirely on the flowers of the banana, and has a very beautiful reddish-bronze tint. The other, which is much smaller and more gaily coloured, occurs up to 11,000 feet, and seems to feed chiefly on a large Acanthaceous flower which grows in enormous profusion at that height; it also feeds on other characteristic shrubs of that region, chiefly of the same order. The Crowned Crane is extremely common all round Ruwenzori, but particularly in the Semliki valley.

With regard to Reptiles and Amphibia, I understand from Dr. Günther that amongst my specimens there is a new Chameleon represented.

Turning to the insects, a very curious Beetle (*Heliocopus colossus*) of enormous size seems to be very common along the East Ruwenzori in places where Elephants exist. It is found only in their dung, in which it lays its eggs. I also found examples of another species, *H. hamadryas*.

Perhaps I may be allowed to say that, taking the remarks which I have obtained from those who have looked at my zoological specimens, the general impression seems to be that there is at Ruwenzori a meeting-point of two very distinct faunas, one western and the other Abyssinian and Cape. This coincides very closely with my own impressions of the flora. From the mountains of Abyssinia along the east coast—keeping, *i. e.*, at an altitude of 4000 feet—down to Mashonaland there is a flora which becomes gradually more and more like that of the Transvaal. The Shiré Highlands' plants are much nearer those of Mashonaland than one would suppose. The West-African and Congo flora seems to have mingled with this northern flora at Ruwenzori, where one of the valleys, the Wimi, contains many western forms.

I think there is some reason to suppose that the Uganda plateau, or, one might say, the range of Jackson's Hartebeest, is a minor offshoot of this Abyssinian-Cape affinity, of which Somaliland (with Swayne's Hartebeest) represents another offshoot—

Coke's and Lichtenstein's Hartebeests representing the transitional stages to the purely Cape form *Bubalis caama.*

There is a very curious breed of cattle which is the common form in Urundi, Karagwe, and Mpororo, and also occurs sporadically in Buddu. The most singular feature is the enormous horns, sometimes three feet long and as far apart at the tips. The udder is very small and the hump inconspicuous. They are brown all over, not like the other breeds. They have a peculiar way of walking; the fore and hind feet seem to reach the same spot, so that their paths constitute a series of transverse ridges separated by furrows. It seems that they are closely related to the Galla or Sanga Ox of Abyssinia, which were first discovered by Bruce. The Wahima race, which are in a purer condition in this part of Africa than anywhere else, probably brought these animals with them from Abyssinia, and they have probably remained ever since in this country, *i. e.* about 5000–7000 feet in the Urundi hills and also in Mpororo.

The following papers were read:—

1. On the Structure of the Heart of the Alligator. By FRANK E. BEDDARD, F.R.S., Prosector to the Society, and P. CHALMERS MITCHELL, M.A., F.Z.S.

[Received May 6, 1894.]

We have recently had the opportunity of examining the heart of a large Alligator (*Alligator lucius*), lately living in the Society's Reptile-house. As none of the existing figures of the heart of this Crocodilian, particularly of the valves, appears to us adequate, it seems to be worth while to enter into the matter again. The best and most numerous illustrations of the heart are contained in a work by Prof. Sabatier[1]. None of them, however, shows clearly the relative proportions of muscle and fibrous tissue in the auriculo-ventricular valves, which is a matter of such importance in comparing the hearts of the higher vertebrates. Gegenbaur's well-known paper upon the heart of the Crocodile and the Monotreme[2] has no illustrations at all, while Prof. Lankester[3] has, in our opinion, not given an absolutely accurate figure of the right auriculo-ventricular valve, though the illustration is sufficient to bring out the points with which he was concerned in the paper, which did not profess to be a detailed description of the Crocodile's heart. The heart of the Alligator, as has already been noted, lies exceedingly far back in the abdominal cavity enclosed in a stout pericardium of an elastic nature. The pericardium ensheathes the origins of the large vessels, and the point of the ventricles is bound to the posterior end of the pericardium by a stout gubernaculum, as in many Lizards but not in Birds.

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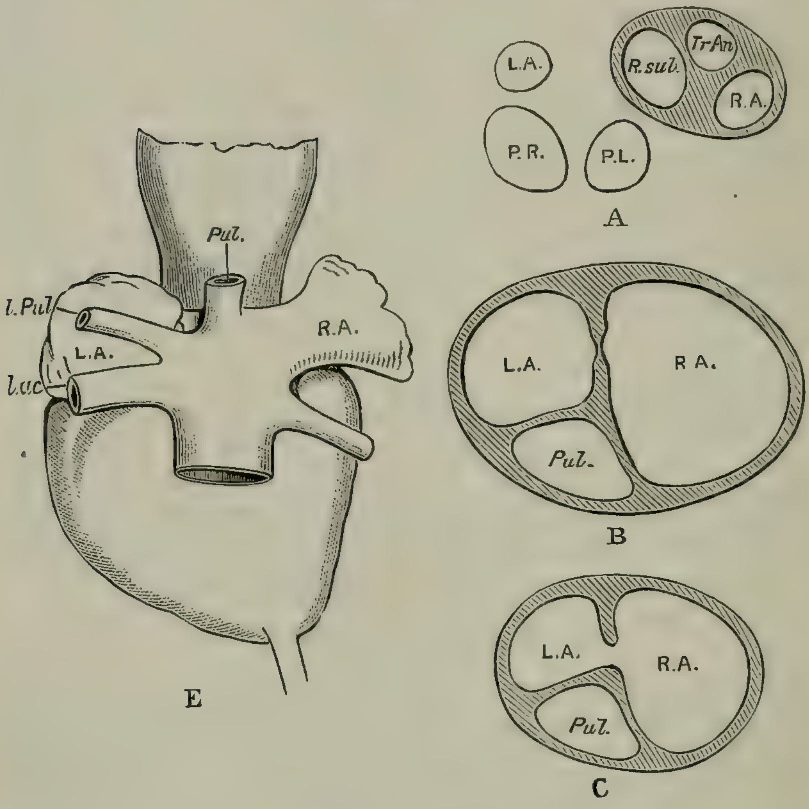
[1] "Le Cœur et la Circulation des Vertébrés," Inaug. Diss., Montpellier, 1873.

[2] "Zur vergleichenden Anatomie des Herzens," Jen. Zeitschr. 1866.

[3] "On the Right Cardiac Valve of *Echidna*, etc.," P. Z. S. 1883, p. 8, pl. iv. figs. 1, 2.

Fig. 1.



Heart of Alligator.

A, B, C. *Sections through the bulbus at different horizons.*

C. In the region of the aortic valves the communication between the aortæ is shown. B. In the largest part of the bulb; A very narrow window separates the aortæ in one region. A. At the summit of the bulb. *Pul.* Common pulmonary trunk on ventral side: P.R., P.L. Right and left pulmonaries. L.A. Left aorta arising from right ventricle; R.A. Right aorta. *R.sub.* Right subclavian: *Tr.An.* Truncus anonymus.

E. *Dorsal aspect of heart.*

L.A. Left auricle. R.A. Right auricle. The letters *Pul.* are placed upon the base of the arterial bulb: the ventricles, with the gubernaculum attached to the apex, form the lower part of the figure. *Pul.* Right pulmonary vein; *l.Pul.* Left pulmonary vein, which is closely attached externally to the left anterior vena cava, *l.a.c.* The right anterior vena cava opens into the sinus opposite *l.a.c.* The large median vessel is the post-caval.

The accompanying drawing (E) illustrates the dorsal aspect of the heart with the sinus venosus overlying it; the sinus venosus is a very small but distinct thin-walled cavity, in position and arrangement markedly recalling that of the Frog. Anteriorly and to the left side the large left anterior cava opens into it; the much smaller right anterior cava opens opposite to the latter on the right side. The postcaval vein enters the sinus in the middle line posteriorly and is of enormously large size. A large coronary vein leaves the line of junction between the ventricles and enters the postcaval after a short free course.

The two auricles are free from the surface of the ventricles, thus differing from birds; they are attached to the dorsal side of the heart, and their free ends are partially wrapped round but do not meet on the ventral side. The right auricle is markedly longer than the left and its free extremity is forked.

The line of junction between the ventricles is plainly marked exteriorly; and it passes down immediately to the right of the gubernaculum, which is thus attached to the left ventricle only. The great vessels which arise from the ventricles are closely attached to each other and form an enormous bulging expansion anterior to the heart, and showing externally no trace of a division into the separate vessels. The accompanying drawings are illustrative of sections through this bulbus arteriosus at different levels.

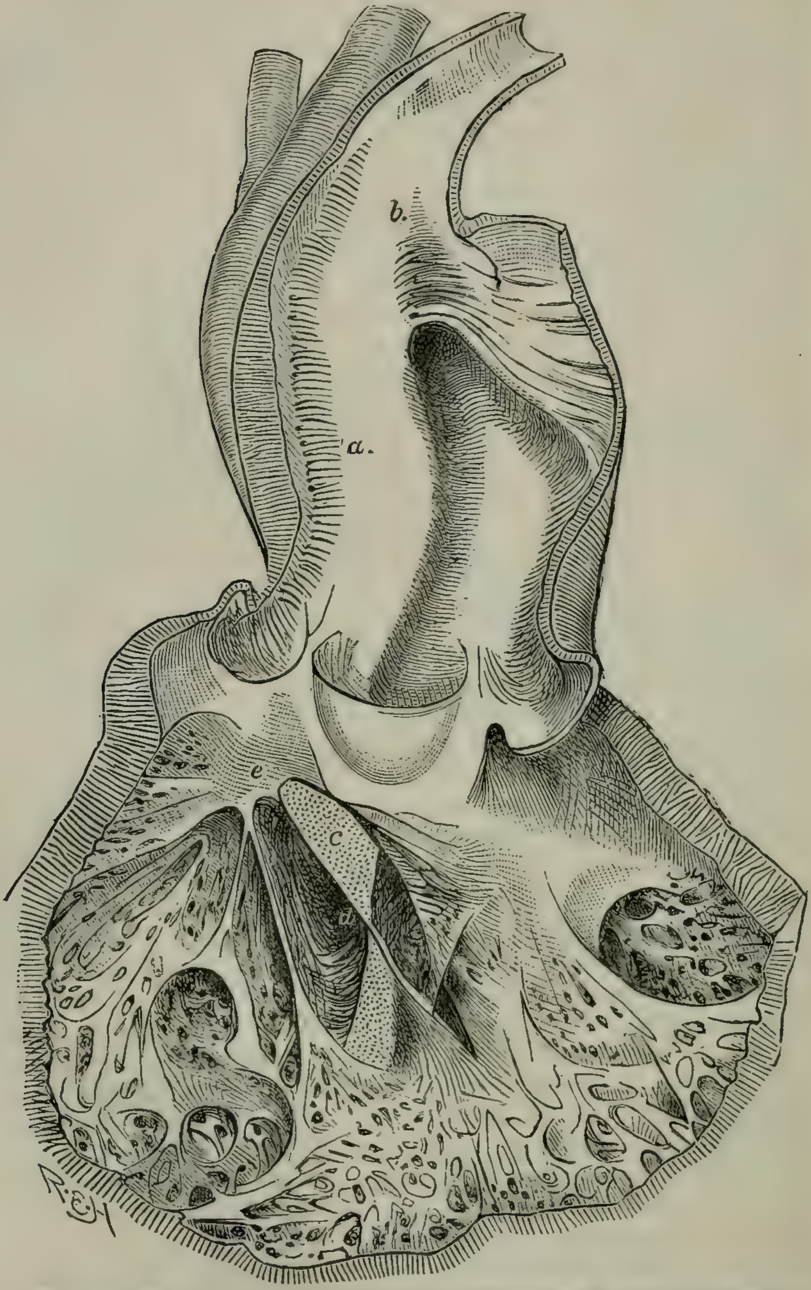
The pulmonary veins enter the dorsal side of the heart towards the left hand; the right pulmonary vein being exactly in the middle line, and the left entering at right angles to it and attached by membrane to the left precaval.

Cavities of the Heart.—The small cavity of the sinus venosus leads directly into the right auricle; the valve between them (atrio-auricular) is bicuspid, being composed of two large thin muscular flaps, each semicircular and like an eyelid in shape; the dorsal valve is slightly overlapped by the ventral at the sides, and the two do not join. The cavity of the right auricle is twice as large as that of the left; the septum between the two is complete and lies in the middle dorsal line of the heart. The interior of both auricles is richly sculptured.

The most striking point, of course, about the interior of the ventricles is the enormous thickness of the spongy walls and the very small amount of free cavity. When the apex was cut off, a well-marked line, concave towards the left ventricle, and situated in the middle of the spongy tissue, showed the boundary of the inter-ventricular septum. The spongy cavities ran closely up to this line, but in no case was it actually penetrated by them. There is in short an absolute separation between the two ventricles.

The *right auriculo-ventricular valve* consists of two separate valvular flaps equal in size; the septal, or inner flap is chiefly muscular, but a triangular piece near the upper free extremity is chiefly membranous, as is shown in the drawing (woodcut fig. 2, *c*). The strand of muscle running along the valve arises by a column with several roots from the septal wall of the heart posteriorly. The right, or outer, valve is entirely muscular (fig. 2, *d*); its upper surface is sculptured, chiefly in vertical lines, and bound to the

Fig. 2.



Heart of Alligator, opened to display the right ventricle and the origin of left aorta.

a & *b*. Two rows of rudimentary valves, the row opposite *b* being shorter and having a deep pit under the lowest of three chief rudimentary valves.

c. Septal flap of right auriculo-ventricular valve; the membranous area is dotted, and a strong muscular band ties down the lower end of the flap to the septal wall.

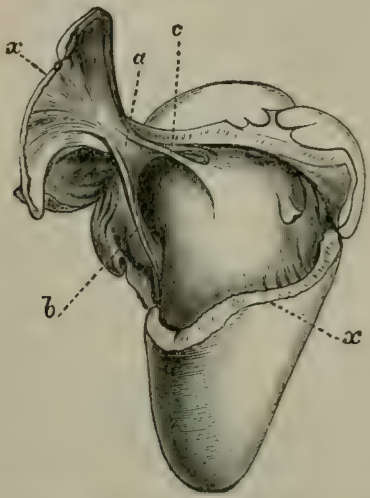
d. Fleshy half of right auriculo-ventricular valve.

e. Muscular band tying down junction of two flaps, and corresponding to bridge in bird's heart.

parietes by delicate muscular threads, which may be compared with the papillary muscles of the valves of the mammalian heart.

In spite of the luminous investigations of Prof. Lankester upon this matter, and of the previously expressed views of one of us[1], we cannot regard the morphological relationship of the different parts of the valve of this animal and that of the bird as thoroughly cleared up.

Fig. 3.



Heart of the Common Fowl, opened to display the cavity of the right ventricle.

x, *x*. Cut surfaces.
b. Right part of the valve identified by us with right part of valve in Alligator (fig. 2, *d*). *c*. Septal part of valve identified by us with Alligator's septal flap (fig. 2, *c*). *a*. Muscular bridge identified by us with structure shown in fig. 2, *e*.

The view taken by Prof. Lankester, and generally accepted, is that the entire fleshy valve of the right (*b*) ventricle of the Bird's heart corresponds to one half only of the complete valve of the Crocodile[2] and of the Mammal; in the Bird it is held that the septal half of the valve is quite absent and not even represented by rudiment. Now, if we consider the Bird's heart in a position exactly corresponding to that of the Alligator as shown in our drawing (fig. 3), this comparison seems to be inexact. The larger half of the valve lies on the right side, and is of course entirely fleshy; in the Ostrich, which we have recently had an opportunity of examining and which was typically avian in every respect, this half of the valve was slightly sculptured on its right face near to the origin from the walls of the heart. A comparison in this matter with the corresponding face of the same valve in the Alligator will be obvious (see fig. 2). As will be seen by an inspection of the accompanying drawing (fig. 3), which we are enabled to reproduce here by the courtesy of Prof. Lankester, this half of the valve is bound down anteriorly to the outer wall of the ventricle by a strong muscular bridge. This muscular bridge is also connected with the anterior edge of another valve which is much shorter than the one just described, but which runs approximately in the same direction as the last, *i. e.* nearly parallel to the longitudinal axis of the heart. This has generally been accepted as part of the longer valve and as not corresponding to the septal flap. We are, however, unable to agree with this interpretation of the structure. In its relations it corresponds exactly to the septal flap of the valve of the Alligator; the upper end of the two valves in the Alligator are in the same way bound down by a strong band of muscle; it is true that this muscle does not form a definite bridge, but it stands out in relief, and as the spongy wall of the ventricle is so much thicker, we cannot regard the obliteration of the space beneath as of any morphological significance: in fact we identify what has been called the inner part of the valve in the Bird's heart as the septal flap of the valve of the Alligator's heart. It is identical in relative position, in its mode of attachment; and in some birds we have seen a slight development of tendon in its substance. Furthermore, the direction of the muscular fibres is not continuous round what has been regarded as the continuous edge of the valve. As to its disproportion in size, we do not see that the amount of development as compared with the nature of the development is a point of much significance.

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[1] F. E. Beddard, "On the Heart of Apteryx," P. Z. S. 1885, p. 188, and "Notes on the Anatomy of the Condor," P. Z. S. 1890, p. 142.

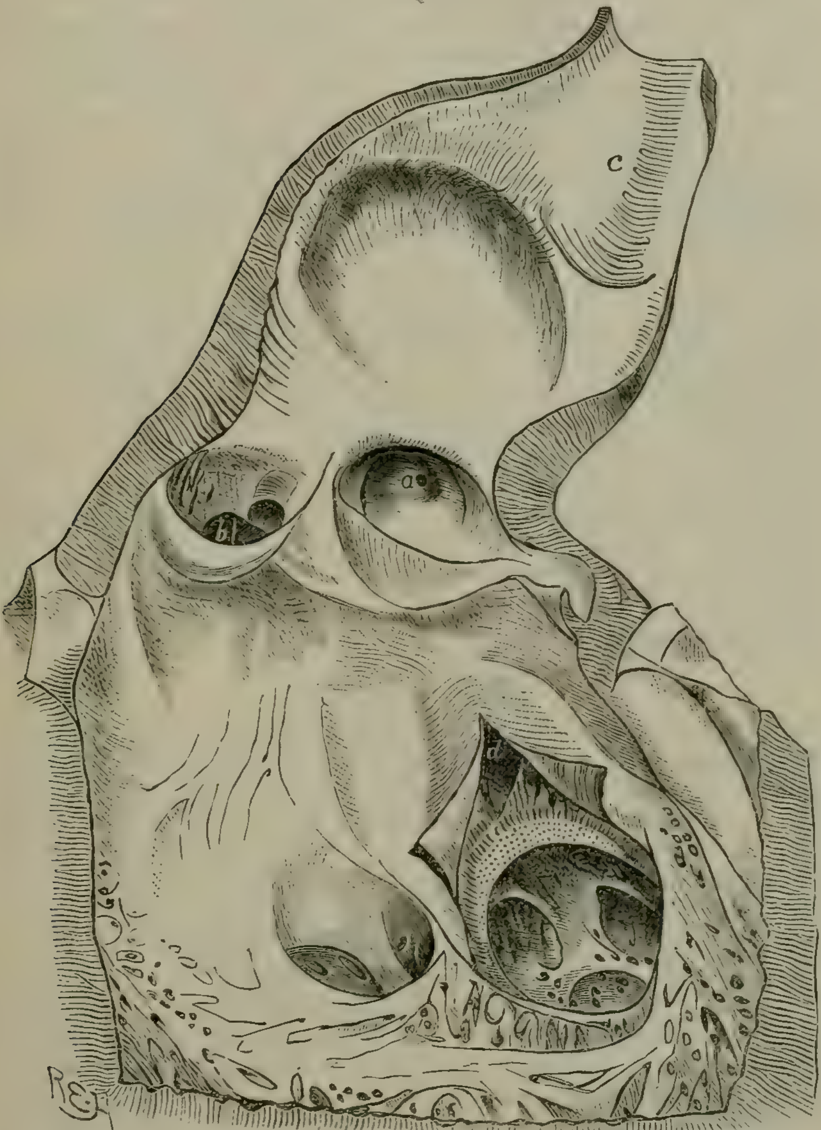
[2] "Bei Vögeln am rechten Ostium die mediale endocardiale Taschenklappe der Krokodile vollständig geschwunden," Röse, Morph. Jahrb. 1890, p. 80.

The left auriculo-ventricular valve, illustrated in the drawing (fig. 4), consists of two separate vertical flaps, of which the septal is considerably larger and overlaps the left flap; the septal valve is thinner, and is composed of both muscles and tendon. The left half of the valve has the free crescentic edge strongly ligamentous, the remaining part being muscular.

The left aorta arises of course from the right ventricle; its exit is guarded by three watch-pocket valves, on the free edge of which are cartilaginous hardenings; the exit is narrow, and the aorta then dilates into a wide chamber in the bulbus. In this are two rows of small sculpturings like rudimentary valves extending to the top of the wide part of the aorta, each row being vertically above the middle of one of the valves (fig. 2, *a*, *b*). The pulmonary artery arises from the same ventricle; its exit is similarly guarded by three valves and it similarly dilates into a wide expansion in the bulbus; the pulmonary artery at the end of the dilatation divides into two branches, which, however, leave the bulbus on its ventral aspect and not, as figured in Wiedersheim, on the dorsal aspect.

The right aorta arises from the left ventricle; its narrow exit is guarded by two wide valves, behind the left of which arises the coronary artery. Behind the right lies the very large communication with the left aorta. The aorta then expands into a very wide sac in the bulbus; in a line with the communication between the two aortæ, and nearly an inch and a half anterior to it, there is a deep pit in the right aorta, shown in the drawing (fig. 1, B). This is separated by a transparent window from the space behind the lowest of the three principal rudimentary valve-like structures in the left aorta; however, there is no actual communication.

Fig. 4.



Heart of Alligator, opened to show the left ventricle and origin of the right aorta.

a. Aperture of coronary artery. *b.* Foramen Panizzi. *c.* Right aortic arch. *d.* Outer or left flap of left auriculo-ventricular valve cut through to show, underlying it, the septal flap of the same valve, which is larger in size, and the membranous margin of which is indicated by the dotted area in the drawing.

2. On the Anatomy of *Chauna chavaria*.

By P. Chalmers Mitchell, M.A., F.Z.S.

[Received May 6, 1895.]

Owing to the kindness of my friend, the Prosector of the Society, Mr. F. E. Beddard, I have had the opportunity of examining the anatomy of a female specimen of *Chauna chavaria*, the Crested Screamer. Garrod (**1**) has given an account of the anatomy of *Chauna derbiana*; Mr. Beddard and I (**2**) have published the results of our investigation of *Palamedea cornuta*; but less has been written about *Chauna chavaria*, and I have thought it worth while to examine carefully this third of the three known species of the Palamedeidæ.

External Characters.

The skin was very emphysematous, even upon the tibia, thus differing from *C. derbiana*, but, as in that and in *Palmedea*, there was a triangular space on each shoulder undistended by air.

The number of rectrices was 12, as in *C. derbiana*, not 14 as in *Palamedea*. The wing was aquintocubital as in *C. derbiana* and in *Palmedea*[1].

As Nitzsch states, there is a small aftershaft on some of the feathers on the nape of the neck. This is absent in other regions.

The oil-gland is natiform, and is tufted and covered by feathers. It has two large apertures separated from each other by a narrow line of feathers.

Viscera of Abdomen.

I have little to add to Beddard's description of the septa (**3**). As in *Palamedea*, the lobes of the liver are not shut off from the subomental space. The falciform septum is nearly median and extends unusually far back, reaching to within half an inch of the ends of the pubes. The horizontal septum was a stout brown membrane attached to the pubes behind and forking over the stomach. The oblique septa stretched from the pubes to the pericardium, and contained numerous striæ in their thick walls.

The lobes of the liver were more nearly equal in size than in *Palamedea*. The gall-bladder was large, and the cystic, hepatic, and single pancreatic ducts entered the summit of the ascending loop of the duodenum exactly as we described in *Palamedea* (**2**), and not at the position described by Garrod for *C. derbiana* (**1**).

The proventriculus (*s*) was very capacious, and, as Garrod describes in *C. derbiana*, the glandular area forms a narrow zone round the anterior end and a long triangular patch stretching down on the side. In this respect, certainly, the proventriculus is, as Garrod pointed out, similar to that of the Ostrich; but in the Ostrich the zone is not complete above, and the proventriculus is unsymmetrical in shape. The small gizzard of *Chauna chavaria* exhibited a strongly marked central tendinous area on each of the opposite faces, very dissimilar from the double tendinous area found on each of the similar areas in the Ostrich and Goose.

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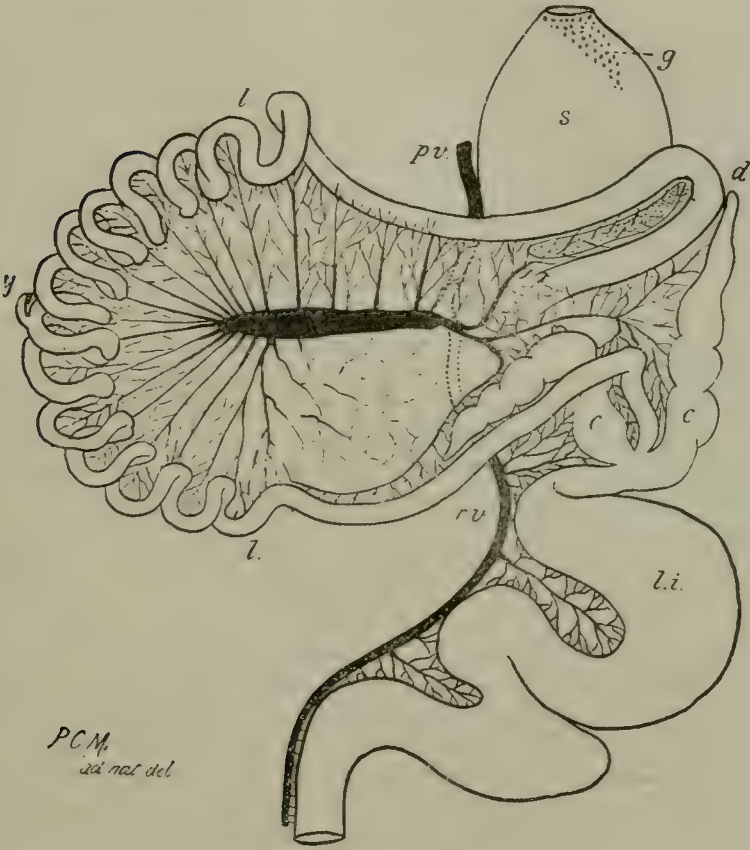
[1] In our paper on *Palamedea* (P. Z. S. 1884, p. 536), by an oversight, we stated that the wing was quintocubital. We have examined three specimens and found the fifth feather absent in each.



Intestine of *Chauna chavaria.*

s. Proventriculus with *g* the glandular patch.

d. Duodenum enclosing the pancreas (the duodenum has been turned forwards).

l to *l.* The large loop of the intestine, with *y* the yolk-sac diverticulum about the middle of its length. This coil has also been raised up and turned forwards. The remains of the ventral mesentery running from the diverticulum are not shown, as they lie under the intestinal loop.

c c. The cæca. *l.i.* Large intestine.

r.v. Rectal mesenteric vein. This dips under the mesentery of the large loop, where its course is shown by a dotted line. It there joins with the large central vein of the large loop and with the veins from the duodenum and cæca, and the blood passes forwards, its course being shown by a dotted line, to the portal vein *p.v.*

In the accompanying figure I show the arrangement of the coils of the intestine disposed in a fashion which, from the examination of a number of birds, I have found to be most instructive. The intestines were removed bodily from the abdominal cavity after division of the œsophagus and of the rectum in front of the cloaca. They were then placed on the table with the ventral side upwards, and with as little disturbance as possible the overlying folds were turned outwards. The duodeum (*d*) is a short loop enclosing the pancreas in the usual fashion. Then follows a very long small intestine (*l*–*l*) suspended at the circumference of a nearly circular expansion of the original straight mesentery running from the liver to the rectum. This loop of the intestine corresponds in position and arrangement to the anterior of the two enormous loops which compose the gut behind the duodenum in the Ostrich. It also corresponds to the five or six more specialized loops found in the intestine of Anatidæ, but remains in what appears to be a more primitive condition. At the end of the first large loop the intestine passes into the large intestine and the cæca are attached at the point of junction. The cæca in my specimen were different from those of the *C. chavaria* described by Beddard (**3**), in that they were nearly equal in size and much more sacculated than in the figure given by Beddard. The right cæcum was closely bound to the distal part of the great loop of the intestine running forwards along it. The left cæcum was attached to the descending loop of the duodenum, and in the figure is represented as turned forwards along with that.

The rectum, as in *C. derbiana* and *Palamedea*, was very long and wide, although not nearly so long relatively as in the Ostrich. I do not give the measurements of the parts of the intestine, as from my own observations, and still more from the extended observations of Garrod, Beddard, and others, it seems that the amount of individual variation makes comparisons of little value.

Attached to the free or primitive ventral side of the large loop of the intestine, and nearly in the middle of its length, was a small cæcum (*y*), the remains of the original yolk-duct. From the point of this a short ventral mesentery with a thickened edge ran forwards towards the liver. In the Ostrich the remains of the yolk-sac lie in the same relative position, and I have found in that the remnant of a similar ventral mesentery.

A large number of radial veins leave the large loop of the intestine and converge upon an elongated, much expanded, large tributary of the portal vein. This runs inwards in the middle of the circular mesentery opposite the yolk-sac diverticulum. It is joined by a branch from the right cæcum and from the distal part of the loop; next, by one from the left cæcum, next by one from the duodenum.

Another large vessel from the large intestine joins these vessels, and from their meeting-point the large mesenteric vein joins with a small splenic vein and runs forwards as the portal vein. I may mention that the disposition of these vessels is similar in the Ostrich.

Windpipe.

I have little to add to Beddard's description of this organ (3). The two pairs of extrinsic muscles were as he found them. The syrinx was notched only at the back, as in *C. derbiana*. None of the bronchial semirings were ossified.

The Heart.

This organ was typically avian. The only peculiarity worth noting was in the right auriculo-ventricular valve. In the smaller part of the valve, which Beddard and I have identified with the septal flap of the Alligator's similar valve, I found a small tendinous area. The edge of the flap was muscular, one strand of muscle running to the bridge of muscle which binds the two flaps to the wall of the ventricle. Another band of muscle passed from the lower edge of the valve to the septal wall of the ventricle, exactly as in the Ostrich and in the Alligator.

The Buccal Cavity.

The tongue was identical with that of *C. derbiana*, as described by Garrod.

Between the rami of the mandible, anterior to the *mylohyoid anterior*, lay a pair of large pear-shaped glands opening into the floor of the mouth at the anterior end, just behind the lower beak, by a number of small apertures on each side of the middle line.

MYOLOGY.

In my account of this I shall follow the description recently given by Beddard and myself of the myology of *Palamedea* (2), as in the main the two birds are very closely alike.

In the muscles of the neck and trunk the only point worth noting is that the new muscle described by us as the *costo-sternalis externus* was also present in *Chauna chavaria*. It arises by a flat tendon from the third, fourth, and fifth ribs and is inserted to the costal edge of the sternum, less than half an inch from the posterior end. As in *Palamedea* it may be taken as replacing physiologically, to a certain extent, the absent uncinate processes.

Head-Muscles.

Dermo-temporalis and *biventer maxillæ* as in *Palamedea*. *Digastric* or *depressor mandibulæ*, as in *Palamedea*, consists of two parts. The external portion arises by a strong tendon from behind the external auditory meatus; it runs downwards and forwards, and is inserted fleshy along the upper edge of the angulare. The inner portion is almost entirely tendinous; its origin is below that of the outer portion and its insertion is to the ventral and median side of the origin of the angular process.

Temporalis consists of four clearly separated portions. The most external portion is the largest. It arises fleshy from a curved line over the ear from the posterior edge of the orbit to the edge of the *biventer maxillæ*. Its fibres run downwards and forwards under the maxilla, to be inserted along the inner edge of the mandible. The second portion is the most anterior. It is a comtively narrow band, strongly tendinous, passing from the posterior inner wall of the orbit near the postorbital process: its fibres run downwards and outwards, and, passing under the maxilla, are inserted into the mandible internal to the first portion. The third portion lies behind the second, and is shorter. It arises from the under edge of the orbital process of the quadrate, and, passing parallel to the second portion under the maxillary bar, is inserted into the inner side of the mandible.

The fourth portion does not act as an elevator of the lower jaw. It is a broad fleshy mass, deep within the orbit, passing from behind the optic foramen to the upper and inner edge of the orbital process of the quadrate.

Pterygoid. The first portion is muscular only at its origin from the internal articular process of the lower jaw. It becomes a strong superficial band of tendon, which in front spreads out in the strong membrane covering the palate. The second portion is a broad muscular mass arising from the internal articular process all along its length. The fibres run forwards and are inserted to the pterygoid and the ventral surface of the palatal bones. The third portion is a broad mass external to the second; it arises from the inner face of the lower jaw behind the second portion, and running forwards and inwards is inserted to the outer and upper surfaces of the palatal bone.

The Hyoid Group.

Mylohyoid anterior. The two divisions seen in *Palamedea* were not marked; the muscle, which was well marked, arises from the inner side of the lower jaw anterior to the region of the basihyal. The fibres run straight across the surface of the lower jaw and meet their fellows of the other side in a median raphé. Some of the posterior fibres spread out as a diffuse sheet.

Mylohoid posterior. The origin was as in *Palamedea*. The posterior thinner portion was exactly as in *Palamedea*, where we described it as a *platysma myoides*. The narrower anterior portion was a stout ribbon of muscle running forwards and inwards superficial to the ceratohyal, to be inserted to the inner surface of the base of the cornu and to the outer surface of the urohyal, in fact to the angle formed by the meeting of these two parts of the hyoid apparatus.

Geniohyoid. As in *Palamedea* this muscle was wrapped round the posterior portion of the cornu of the hyoid, and then passed forward to be inserted to the inner surface of the lower jaw behind the *anterior mylohyoid.*

Genioglossus absent, as in *Palamedea*.

Ceratoglossus. Only the second part present, and that was as in *Palamedea.*

Ceratohyoid as in *Palamedea.*

Hypoglossals. There is a well-marked *hypoglossus rectus* arising fleshy at each side from the entoglossum, and ending in a long tendon running forward to the tip of the tongue. Undoubtedly this muscle is what we described as the first part of *ceratoglossus* in *Palamedea.*

Thyrohyoid. A well-marked muscle at each side arising from the side of the basihyal and spreading out over the thyroid cartilage. This we described in *Palamedea* as belonging to the system of the sternohyoid.

Caudal Muscles.

The five muscles were exactly as in *Palamedea*, except that the inner thinner portion of the *ilio-coccygeus* was absent.

Muscles of the Shoulder-girdle.

Rhomboideus externus and *internus*, *serratus anticus*, *pectoralis minor*, *sterno-coracoid*, *coracobrachialis longus*, *coracobrachialis anterior* and *c. internus*, *deltoides minor*, *teres major*, *subscapularis*, *expansor secundariorum*, *biceps*, *triceps*, *extensores metacarpi radialis* and *ulnaris*, *ectepicondylo-ulnaris* and *radialis*, *extensor digitorum communis*, *extensor indicis longus*, *pronator sublimis*, *brachialis inferior*, *flexor digitorum sublimis*, *ulni-metacarpalis ventralis*, *abductor pollicis*, *flexor pollicis*, *abductor indicis*, *flexor digiti III.*, and *interossei dorsalis* et *palmaris* were as we described them in *Palamedea.*

Serratus posticus. The origins were a rib further back than in *Palamedea.* *Pars metapatagialis* arose from the sixth complete rib. Part two came from the fourth, fifth, and sixth ribs.

Latissimus dorsi differed from that in *Palamedea* only by the absence of a metapatagial slip from the tendon of insertion of the posterior part.

Pectoralis major arose partly from the posterior sternal rib.

Coracobrachialis brevis (*subcoracoideus*) was represented only by a ligament.

Deltoides major was not divided into two portions, and the upper region of its insertion was not tendinous.

Patagialis arose as in *Palamedea*, and the general disposition of the tendons was as in *Palamedea.* But, as Fürbringer has already figured, the *brevis* ligament unites not only with the *extensor metacarpi radialis*, but passes over to the ulna. As in *Palamedea* there is no *biceps patagialis.*

Teres minor (*supraspinatus*) was not present.

Anconæus longus. This is as in *Palamedea*, but there were no tendinous bars, uniting the tendons of the head and of the accessory head.

Extensor longus pollicis. The ulnar head was very small and had no tendon.

Pronator profundus was larger than *pronator sublimis.*

Flexor digitorum profundus reached nearly to the tip of the second phalanx of digit II.

Flexor carpi ulnaris. The sesamoid was not ossified.

Extensor brevis pollicis arose by two fleshy digitations from the dorsal face of metacarpal I. It was inserted to the base of the thumb.

The second *abductor pollicis,* described by us in *Palamedea,* was not present.

Radio-metacarpalis ventralis absent.

Ulni-metacarpalis dorsalis, not found by us in *Palamedea,* present. The origin is a strong tendon from the distal end of ulna on its dorsal surface near the radius. It divides into a series of digitations, the most radial of which is inserted by a tendon to the base of metacarpals II. and III., the others fleshy to the ulnar side of metacarpal III.

Muscles of the Thigh and Leg.

Sartorius, glutei anterior, medius, minimus, quartus, pectineus, vastus externus, cruræus, vastus internus, biceps, obduratores externus et internus, gemellus, ambiens, soleus, tibialis anticus, extensor communis digitorum, flexor perforatus et perforans medii, flexor perforatus, flexor profundus, popliteus, flexor brevis hallucis, flexor brevis hallucis secundus, flexor brevis indicis, extensor hallucis, extensor hallucis secundus, abductor indicis, extensor medii, abductor annularis, are all as in *Palamedea.*

Glutæus maximus. The representative of the postacetabular part of this muscle found by us in *Palamedea* is absent.

Femoro-caudal. There was only a tendon of origin: the insertion in the tail was fleshy.

Accessory femoro-caudal. This muscle, absent in *Palamedea,* is present in *Chauna chavaria.* Garrod states that it is present also in *C. derbiana.*

Semitendinosus. The accessory is larger than in *Palamedea.* The tendon from the two heads joins the inner head of the *gastrocnemius,* not the middle as in *Palamedea.*

Semimembranosus. The tendon of this, after receiving a slip from the tendon of the *semitendinosus* as in *Palamedea,* runs into the tibia between the inner head of the *gastrocnemius* and the *accessory semitendinosus.*

Adductors. There is not so great a difference in size between the two adductors as in *Palamedea.* The origin of the deeper *adductor* extends also to the end of the pubis. As in *Palamedea,* one set of the fibres are inserted to the femur; the other set join, not the middle head of the *gastrocnemius,* but the accessory *semitendinosus.*

Gastrocnemius. The outer head is as in *Palamedea.* The middle head is slender, but is quite distinct from the *accessory semitendinosus*; it arises tendinously from the intercondylar notch and it joins the outer head of the *gastrocnemius* halfway down the leg. The inner or tibial head arises from the internal condyle of the femur in addition to the origin found in *Palamedea.*

Peroneus longus. The fork to the ankle-cartilage consists of four separate branches, becoming wider from above downwards.

Peroneus brevis. The tendon of insertion forks—part, as in *Palamedea*, being attached to a knob on the outer side of the tarsometatarsus, part going to the fascia covering the ankle-joint.

Flexor perforans et perforatus indicis has an additional origin from the end of the tibia.

Flexor longus hallucis. The general arrangement is as in *Palamedea*, and the slip to the toe from below the vinculum, which we found in *Palamedea*, but which Garrod did not find in *C. derbiana*, is present in *C. chavaria*. The vinculum consists of two slips.

Abductor annularis is as in *Palamedea*, but in our paper we called two muscles the *adductor annularis*. The first of these is the abductor.

SKELETON.

I add a few notes on the points of difference and resemblance in the skeletons of *Palamedea* and the two *Chaunas*. In *Palamedea* the whole skeleton is the slightest of the three, and its long bones are the longest. *C. derbiana* has the heaviest skeleton and its long bones are the shortest. *C. chavaria* is intermediate.

Sternum. *C. chavaria* has the posterior lateral processes shortest; *Palamedea* intermediate; *C. derbiana* longest and most anserine. In the *Chaunas* the inner anterior surface of the sternum is pneumatic. It is not so in *Palamedea*.

Vertebræ and Ribs. In *Palamedea* and *C. chavaria* there are 16 cervical vertebræ without movable ribs; in *C. derbiana* 17. Then follow two dorso-cervicals with free movable ribs, the 17th and 18th in *Palamedea* and *C. chavaria*, the 19th in *C. derbiana*. Then follow complete ribs articulating with sternal ribs; 7 on vertebræ 19 to 25 in *Palamedea*; 8 in *C. chavaria*, on vertebræ 19 to 26; 8 in *C. derbiana*, on vertebræ 20 to 27. Lastly, there follows an incomplete rib, of which the articular surfaces are much reduced, and which meets a sternal rib that is attached not to the sternum, but by a fibrous connection to the side of the preceding sternal rib. In *Palamedea* this is borne on the 26th vertebra; in *C. chavaria* upon the 27th; in the skeletons of *C. derbiana* that I have seen it was not present, but its attachments are so slight that it might easily have been lost in maceration. In *Palamedea* the rib on the 23rd vertebra is the most anterior covered by the ileum; in the *Chaunas* it is the 25th. In *Palamedea* and *C. chavaria* the thirty-first is the last vertebra with a transverse process anterior to the acetabulum; in *C. derbiana* the corresponding vertebra is the *thirty-second.*

In *C. derbiana* the penultimate sternal rib has a sharp backwardly directed process near the articulation with the costal rib; this is absent in *Palamedea* and in *C. chavaria*.

Clavicle is V-shaped in *Palamedea*; U-shaped in the *Chaunas*.

Pelvis. The waist is broad in *Palamedea*, narrow in *C. derbiana*, intermediate in *C. chavaria*.

The hinder part of the pelvis is bent downwards upon the fore part in *Palamedea*; it is nearly straight in *C. derbiana*; the angle of inclination is intermediate in *C. chavaria*.

In all three, the pubes do not extend far behind the ischia, and the forwardly turned processes, which in so many *Anatidæ* nearly meet in the middle line and recall the median ventral symphysis of the Ostrich, are absent.

THE SKULL in its general proportions resembles that of *Palamedea* more than that of *C. derbiana*. It has most of the features given in our table (2) as common to *Palamedea* and *C. derbiana*. The foramen magnum is relatively smaller than in *Palamedea*, as in *C. derbiana*. The outer long edge of the palatine is not sharply angular, as in *Palamedea* and *C. derbiana*. The width of the middle superior ramus of the premaxilla is nearly uniform, as in *Palamedea*, not wider at its origin than posteriorly, as in *C. derbiana*. The angular process of the lower jaw is not so straight as in *Palamedea*, nor so sharply upturned as in *C. derbiana* and Geese.

The hyoid. The *basihyal* is unlike that of *Palamedea*, being short and roughly triangular, the apex being anterior. The *urohyal* is long and cartilaginous at its extremity, as in *Palamedea*; but it is anchylosed to the *basihyal*, instead of being freely movable upon that. The *entoglossum* consists of two completely separate paired ossifications.

The *ceratohyals* are stouter than in *Palamedea*, but, as in that bird, consist of two bony pieces with an intermediate cartilaginous segment.

PAPERS QUOTED.

(1) GARROD. "On the Anatomy of *Chauna derbiana*." P. Z. S. 1876, p. 189.
(2) BEDDARD and MITCHELL. "On the Anatomy of *Palamedea cornuta*." P. Z. S. 1894, p. 536.
(3) BEDDARD. "On the Anatomy of *Chauna chavaria*." P. Z. S. 1886, p. 178.

3. Field-Notes on the Antelopes of the Transvaal.

By Dr. PERCY RENDALL, F.Z.S.[1]

[Received February 25, 1895.]

THE REEDBUCK. *Cervicapra arundinum.*

Zulu: *Imsigi* or *Umsagoko.* Swazi: *Ihlangu.*

This animal is to be found in the damp and reedy places along the banks of the Lompangwana River, but it is hard to get a clear shot, in tall rank grass and reeds that are much higher than your head, the stems of which are the thickness of a cedar pencil. Its flesh is coarse and rank, and I think none but natives would eat it for choice.

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[1] [Dr. Rendall has at my request kindly put together these notes, which he made on the Antelopes met with in the Transvaal in 1893 and 1894.—P. L. S.]

THE LESSER REEDBUCK. *Cervicapra lalandii.*

Swazi: *Njala* or *Ihlangu matse.*

This second name signifies the "Reedbuck of the Rocks." Nothing could better describe its haunts, which are always on the hill-sides, and not in the creeks. The Colonial and Boer name for this animal is always the Rooi Rhebok. It is common in the De Kaap district, in pairs or small parties of some four or five individuals. Always wary, and frequenting the bare mountain-sides, it is hard to shoot. Its flesh is excellent, as I can testify.

THE BUSHBUCK. *Tragelaphus sylvaticus.*

Zulu and Swazi: *Inkonka* ♂, *Imbabala* ♀. Shangaan: *Shomo.*

This graceful antelope is to be found in many of the wooded kloofs of the De Kaap district. The adult male are very dark in colour compared with the chrome-yellow of the female. The white spots appear to have a similar arrangement in both sexes.

The neck of the male is nearly devoid of hair. The buck, at bay or wounded, is really dangerous, with its sharp, strong, straight horns; a Swazi of ours had two large dogs killed in as many minutes by an animal which they attacked together.

It is difficult, even with a systematic beat, to drive this antelope from cover, as it doubles and dodges till the last moment. The thickly wooded beds of streams are often chosen by them as a habitat. At night I have frequently heard their sharp hoarse bark, emitted, I believe, only by the males.

THE INYALA. *Tragelaphus angasi.*

The Dutch call this animal the Bastard Koodoo. I got a good series of horns of this rare animal from the River Iembé, which runs into the south side of Delagoa Bay. I know of it from no other locality.

THE PALLAH. *Æpyceros melampus.*

Shangaan: *Impaya.*

This beautiful antelope we found in great abundance between the Sabi and Krokodil Rivers, often in herds numbering some hundreds, in the belt of country infested by the tsetse fly. In March the females and their half-grown young were in separate herds from the males, which were always in troops distinct from one another. Their skins at this period of the year were at their best, the two shades of brown being very distinct.

They formed the principal food of the lions which were plentiful in this district, and we were constantly coming across their remains. Acting as scouts they often prevented our getting shots at larger game which we were busy stalking. Most commonly we found them in company with Blue Wildebeeste and Burchell's Zebra. Their flesh is excellent eating, and formed our staple food.

They have a curious habit of stamping with their feet; the peculiar meaning of this we were unable to settle: their alarm-note, for want of a better term, may be described as a whistle. In this part of the country you always get the smaller form, described as a separate species by Mr. Oldfield Thomas—perhaps, as it is wooded, "thorn veldt" country.

Sometimes we found white patches on the hocks, and in one instance a black patch on the snowy-white chest between the fore legs. When frightened by any sudden noise they made most prodigious bounds into the air, like a Springbuck; and when it was not necessary to shoot them, I have derived great pleasure from these exhibitions of saltatory agility.

THE REHBUCK. *Pelea capreolus.*

Zulu: *Iza.*

This antelope is extremely wary, and from the sentinels they post it is especially hard to approach, as they frequent the very highest ridges, which are destitute of cover. Their alarm-note is a sort of harsh cough, upon which all take flight. They still linger on the highest ridges of the Makongwa Range near Barberton. Their flesh is so constantly affected by a species of warble that it is practically uneatable.

BLUE WILDEBEESTE. *Connochætes taurinus.*

Swazi: *Inkonkone.*

Between the Sabi and Krokodil Rivers this animal exists in considerable numbers. It is often found associating with the Pallah, and also at times with Burchell's Zebra.

It is very fond of making wallowing-places in soft and moist ground, where it kneels and rolls. Trees, such as mimosas, are selected as rubbing-posts, and its horns especially are often found to be much worn down by this constant process.

An old bull we shot had actually exposed the core of his horns in this manner. When charging past you they have a very ferocious aspect, which their behaviour belies; they remind one of a small American Bison, the great disparity of height at the withers and the sloping quarters, together with the mane, are responsible for this likeness. The flesh is uneatable. In a troop of this species, one possessed a pure white tail: a lion which we were following prevented us from shooting this interesting variety. (The White-tailed Gnu, *Connochætes gnu,* is unknown in this part of the Transvaal.) The old bulls of this species, *C. taurinus*, are very often solitary, whereas the other adults of this species are gregarious, generally in small herds of about eight to twelve individuals. That curious odoriferous gland in the fore-foot of the animal seems to be a sexual characteristic.

THE STEINBUCK. *Neotragus campestris.*

Shangaan: *Shipeni.* Swazi: *Njena.*

This species is common in the open flats of the Barberton district on the rolling grassy slopes, haunting the same spots. Startled, it rushes off with rapid bounds at a great pace at first, but at a distance of a hundred yards or more, if not shot at or pursued, will often stand and have a good look at you. With good dogs and a steady shooting horse they can be readily bagged with a shot-gun loaded with S.G. The white tail is very noticeable as it retreats. Its flesh is very palatable.

A variety, which has the local name of the Grys Steinbuck, is found near the Lebomo Mountains. It appears to have coarser hair and shorter legs than the above-mentioned species.

THE GRYSBUCK. *Neotragus melanotis.*

This little animal is found north of the Sabi River as far as the Murchison range, sparingly over the intervening tract of country—the eastern and north-eastern portion of the Transvaal.

THE ORIBI. *Neotragus scoparius.*

Zulu: *Iula.*

This small antelope is now rare in the De Kaap valley near Barberton, and though sportsmen tell me it used to be found in great numbers, yet now it only occurs in pairs, and frequents favourite spots on the higher ridges apart from human habitations or traversed paths. When startled it gives great leaps into the air, and is easily knocked over with a 12-bore and large shot. Its flesh is good, and very pleasant as a stew in particular.

THE KLIPSPRINGER. *Oreotragus saltator.*

Swazi: *Ikoka.*

This quaint little hill-climber is everywhere sparingly distributed over the De Kaap district, wherever the ground is rocky and suitable. On 23rd April, 1894, I had a curious proof of its self-possession, for passing in the Pretoria and Delagoa Bay train, through that wild and rocky defile known as Krokodil Poort, I saw within 15 yards of the train, which was travelling at full speed, two of these small antelopes, which were regarding us most unconcernedly. When frightened, they go over the roughest ground with unerring jumps.

A captive doe which I saw was dangerous to children. On 10th June, 1893, I dissected a female that contained a ¾-grown fœtus. When shot, a slight fall will bring its coarse and bristly hair out, literally in handfuls—a fact that I have never seen satisfactorily explained, caused, as it is, by a most trivial blow or friction in falling.

ROAN ANTELOPE. *Hippotragus equinus.*

Zulu: *Takayezi.*

There were a few of these fine animals on the Oliphants River in the Transvaal. A Boer called one that he had shot a "Bastard Gemsbok," though they have a knack of styling it the "Bastard Eland" also.

THE HARTEBEESTE. *Bubalis caama.*

Zulu: *Indhluzela.*

There are a few of these antelopes on the banks of the Krokodil River, opposite Hector's Spruit, and also in the East Lydenburg District of the Transvaal and in South Gazaland.

SABLE ANTELOPE. *Hippotragus niger.*

Zulu: *Impal-impala.*

Some of these glorious antelopes still linger between the Sabi and Krokodil Rivers, but, as far as we could ascertain, there was only one small troop.

THE BLUEBUCK. *Cephalophus monticola.*

Zulu: *Inpiti.* Sangaan: *Inhlingwaan.*

The feet of this tiny antelope I obtained from a necklace that a native was wearing in the Barberton district of the Transvaal; but I do not believe it is found nearer than Natal, where I got it from the River Umsinkulu. A smaller form (*C. natalensis*?), which is red in colour, is found to the north of Delagoa Bay.

THE DUIKER. *Cephalophus grimmi.*

Zulu and Swazi: *Impunzi.*

This is by far the commonest and most widely distributed of all the small antelopes in the eastern portion of the Transvaal which abuts on Swaziland. Hills and plains, wooded slopes of dongas, and elsewhere this is the first and last species you will see. Its protective resemblance to its surroundings is perfect, and until it moves it is invisible to the keenest sight. The vitality it possesses is proverbial. The flesh is good eating. One case I know of, all four feet were shot away with a charge of buck-shot, and yet it went a hundred yards, until a dog pulled it down. A Martini bullet, unless in a vital spot, will not stop it.

It is easily tamed, and makes an attractive little pet; but the males, when their horns grow, are fearless and even vindictive: a tame buck raised by a friend of mine put his horns first through his hand and then through his thigh, and had to be shot. I know of one instance in which, with both parents captive, a young one was successfully reared. Their skins vary in every conceivable tint of grey and brown in the same district, and are very commonly used by the Swazis for making their "mutyas," or fur girdles.

4. The Skeleton of *Lorius flavopalliatus* compared with that of *Psittacus erithacus.*—Part II. By St. George Mivart, F.R.S.

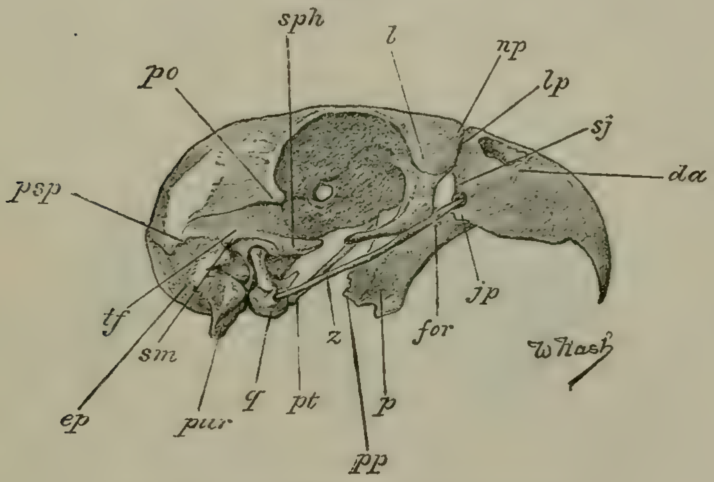
[Received May 1, 1895.]

In a preceding paper[1] I described the postcranial part of the axial skeleton of *Lorius flavopalliatus* and *Psittacus erithacus.* I now proceed to describe the characters presented by the skulls of those two species.

THE SKULL.

General Description.

Fig. 1.



Lateral aspect of skull of *Lorius flavopalliatus.*

da.	Prenasal surface (here not depressed).
ep.	Exoccipital prominence.
for.	Foramen in palatine.
jp.	Jugal process.
l.	Lachrymal, constituting the preorbital prominence.
lp.	Lachrymal process of prosopium.
np.	Nasal process of frontal.
p.	Inferior palatine ridge.
po.	Postorbital process.
pp.	Postaxial, or posterior pala tine, process.
psp.	Postsquamosal prominence.
pt.	Pterygoid.
pur.	Paroccipital process.
q.	Quadrate.
sj.	Suprajugal process.
sm.	Suprameatal process.
sph.	Sphenotic process.
tf.	Temporal fossa.
z.	Zygoma.

THE GENERAL LATERAL ASPECT of the skull of *Lorius flavopalliatus* (compared with that of *P. erithacus*) shows a cranium rather more flattened, a relatively somewhat more slender and elongated bony beak, a more nearly enclosed orbit, palatines which do not descend beyond the level of the ventral margins of the quadrates, an occiput which is less rounded and more sharply inclined preaxiad above the lambdoidal ridge but more rounded and projecting below the latter, and paroccipital processes more sharply inclined backwards and also more distinct from the relatively smaller quadrates.

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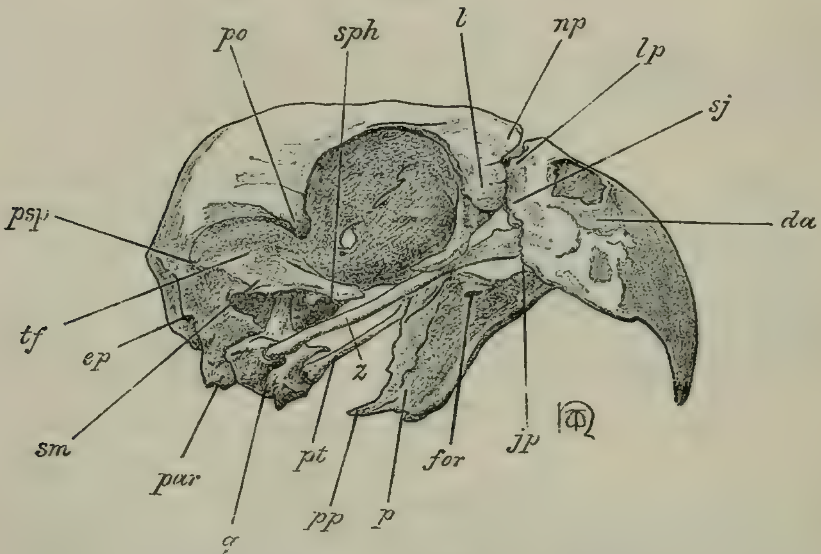
[1] See P. Z. S. 1895, p. 312.

THE GENERAL DORSAL ASPECT of the skull (see fig. 3, p. 367) shows, compared with that of *P. erithacus*, a relatively short bony beak on account of the sharp vertical deflection of the latter towards its apex. The skull behind the cranio-facial articulation is flatter and the orbits somewhat more deeply incised, the deepest part of the incision being more preaxially situated in the orbital margin. The middle part of the hinder (occipital) margin presents a slight median concavity instead of an evenly and very slightly curved convexity. The dorsum of the skull is flatter antero-posteriorly than in *P. erithacus*.

Fig. 2.



Lateral aspect of skull of *Psittacus erithacus*.

da. Depressed area in front of nasal aperture.

(The other letters the same as in fig. 1.)

THE GENERAL VENTRAL ASPECT (see figs. 6 & 7, p. 378) of the skull of *L. flavopalliatus* is very similar to that of the skull of the Grey Parrot, but, as in the dorsal view, the bony beak forms a less proportion of it, as does the space occupied by the palatines, while the *basis cranii* is relatively more antero-posteriorly extended, the quadrates more anterior in position, while the very elongated lachrymal processes extend beside the zygomata for much more, instead of much less, than half the antero-posterior extent of the latter.

THE GENERAL ANTERIOR ASPECT of the skull (see fig. 8, p. 382) of the Lory is very like that of *P. erithacus*, but the apex of the beak is more narrow and elongated, the nares looking more upwards and less outwards, the postorbital processes project less laterally, while the lachrymals are relatively broader, their processes more elongated, and the palatines also diverge slightly more ventrad. The mandible has its antero-dorsal margin more angular instead of rounded, resembling a very obtuse pointed arch inverted (see figs. 18 & 19, p. 393).

It differs also in not having lateral defects of ossification and in the less relatively vertical extent of the most postaxial part of each ramus.

THE GENERAL POSTERIOR ASPECT of the skull (see fig. 11, p. 385) presents us with a dorsal margin more flattened than in *P. erithacus.* Its surface is less concave medianly and less convex on either side of such concavity. The palatines diverge slightly more ventrad, and between them the bony beak shows a sudden narrowing between the lateral tooth or notch of either side, and ventrad of this it is narrower and more pointed. The quadrates jut out slightly less instead of decidedly more than the postorbital processes, and the middle of the occiput, just above the relatively somewhat wider foramen magnum, presents a rounded more marked convexity from side to side.

The apex of the mandible seems more prolonged, showing more of the ventral surface of the relatively more extensive symphysial portion.

Detailed Description.

I. THE BONY BEAK OR PROSOPIUM[1].

The prosopium, when VIEWED LATERALLY (see fig. 1), shows a dorsal margin which descends preaxiad in front of the nares, less sharply than in *P. erithacus*, though from just over the tooth on the ventral, or tomial, margin it arches even more rapidly; so that the apex of the prosopium descends rather more vertically, while it is proportionally narrower antero-posteriorly, where it begins to project ventrad of the line of the tomial margin, and is more pointed towards and at its apex. From a little in front of the preaxial margin of the nares back to the articulation of the prosopium with the cranium, the dorsum thus viewed is almost straight.

The nares are each longer antero-posteriorly and seem narrower dorso-ventrally because they look more upwards and less outwards than in *P. erithacus.* Their preaxial margin rises as a somewhat more marked ridge, while the surface of the prosopium in front of and below each nostril presents no depressed fossa.

In *P. erithacus*, on the other hand, there is (see fig. 2) just in front of and below each nostril a depressed area (*da*), the greatest breadth of which is more than two-thirds the diameter of the nostril, and is bounded below by a very marked groove which runs postaxiad to the postaxial border of the nostril, which border may be perforated by a series of small foramina, or these may be replaced by notches as in *L. flavopalliatus.*

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[1] By this term I intend to denote the whole ossified mass in front of the cranio-facial articulation and the articulations of the zygomata and palatines. It includes the premaxilla, the maxillæ, maxillo-palatine processes, the nasals, and the ethmoidal and turbinal ossifications of the beak.

The lateral surface of the prosopium in front of a vertical line descending ventrad from the preaxial margin of each nostril is in *P. erithacus* slightly swollen and convex antero-posteriorly and rather more so dorso-ventrally. It is slightly more convex in both directions in *L. flavopalliatus*, in which also the more posterior portion of the side of the beak is less flattened than in *P. erithacus.*

The ventral margin of the prosopium is, as already implied, more sharply curved in front of the tooth. The tooth itself is thus slightly more prominent, and the tomial margin behind it is slightly more convex than in *P. erithacus.*

Postaxially the tomial margin ends in what may be called the jugal process (*jp*). It is broader and more rounded from within outwards, while above it the concavity which receives the preaxial end of the zygoma into it is much more marked in *L. flavopalliatus.* The jugal process itself extends relatively more postaxiad and somewhat more ventrad than in *P. erithacus*, so that the tomial margin presents a slight concavity towards its postaxial end, though very much less than that formed by the tooth and the parts in front of it. The upper boundary of this concave margin (which is the dorsal margin of the fossa for the zygoma) forms a suprajugalar (*sj*) process much like that of *P. erithacus*; but while in the latter species the postaxial margin of the beak above the suprajugalar process is postaxially concave and terminates dorsally in a small but distinct lachrymal process (*lp*)—which is received into the frontal beneath a slightly marked prominent nasal process (*np*) of the latter bone—in *L. flavopalliatus* the postaxial margin above the suprajugalar process is nearly straight, and ends in a very minute lachrymal process, which more absolutely coincides with the dorsal line of the cranium in this external view of the skull than in the other species.

In the latter, the lamina of bone which intervenes between the apex of the lachrymal process and the nearest point in the postaxial margin of the nostril is about as broad as two-thirds the antero-posterior extent of the nostril, but in *L. flavopalliatus* it is slightly less than half this extent.

The depth of the lamina of bone ventrad of the nostril to the tomial border is one-fourth less than twice the diameter of the nostril. In *P. erithacus* it is only one-fifth less.

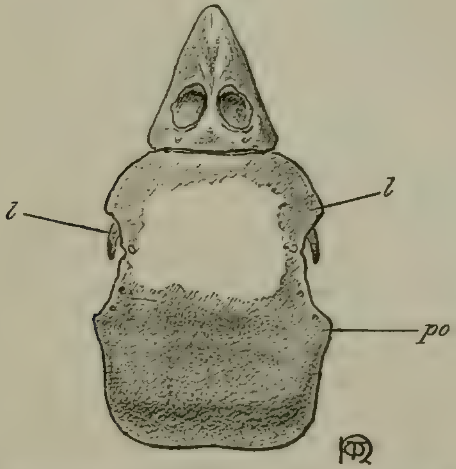
THE DORSAL ASPECT of the prosopium has the outline of an isosceles triangle, the apical angle whereof is of about 50° instead of 40°, as in *P. erithacus.* Its base (the preaxial boundary of the cranio-facial articulation) is straighter and does not so clearly exhibit the curves (a very slight median concavity with two slight convexities external to it, external to which, again, are two concavities each bounded externally by one of the lachrymal processes) which there exist in *P. erithacus.*

The lachrymal processes are relatively as well as absolutely smaller, and instead of projecting strongly outwards as well as backwards project backwards and but very slightly outwards.

The lateral margins of the triangle of the beak, thus viewed, are very slightly convex in both species.

But a great difference exists with respect to the nares. These are relatively larger, occupy a much larger portion of the dorsum of the prosopium, and are much more closely approximated than in *P. erithacus.* The distance from the cranio-facial articulation to a line joining the most preaxial parts of the margins of the nares is quite half the antero-posterior extent of the prosopium thus viewed, instead of less than half; while the internasal lamella, instead of about equalling the diameter of each nostril from within outwards, is less than a third of it.

Fig. 3.



Dorsal aspect of skull of *Lorius flavopalliatus.*

l. Lachrymal, constituting the preorbital prominence. | *po.* Postorbital process.

A large foramen exists in the middle of the dorsal lamella, separating each of the nares from the cranio-facial articulation, and just behind the outer part of the hinder margin of each nostril. These foramina I do not find in *P. erithacus.*

In the latter species, in the relatively broad lamella separating the two nares, there is a depressed area in the form of two grooves which run backwards—from a point in the middle of a line joining transversely the antero-posterior middle points of the dorsal margin of the nares—to the postaxial dorsal margin of the prosopium. From between these two lateral grooves, another groove runs forwards along the middle of the dorsum of the beak, nearly to an imaginary line which would connect the anterior margins of the two depressed areas in front of the two nares or further forwards. The groove then bifurcates, its two branches diverging at an angle of about 12°, and running forwards towards the ventral margin of the beak, but stopping short of it by a distance about equal to the diameter of each nostril, and each ending in a foramen which leads into the substance of the bone.

In *L. flavopalliatus* there is none of all this, save that a groove appears on the mid-dorsum at a point coinciding with the level of the antero-posterior middle of the nares, and then similarly bifurcates—its two branches running forwards and similarly terminating in foramina on each side of the beak at some distance from its apex.

THE VENTRAL ASPECT of the prosopium (see figs. 6 & 7, p. 378) presents a palatal surface slightly more concave both antero-posteriorly and transversely than in *P. erithacus*. In the latter species this surface is crossed by a very slightly marked ridge the median part of which is the most preaxial, the two lateral halves of the ridge thence diverging backwards at an angle of about 140°; this median point of divergence is rather nearer to the apex of the prosopium than to the hinder margin of its palatal surface. From immediately behind it, an antero-posteriorly directed groove runs postaxiad and leads to a small foramen, beneath which the margins of the groove medianly unite, and thence an antero-posterior prominence may continue on in the same direction as the groove and for about the same length, subsiding entirely before reaching the hinder margin of the palate.

In *L. flavopalliatus* there is no transverse ridge but only a slight smooth swelling of the palatal surface in about the position of the middle of that transverse ridge in *P. erithacus*. In front of this is a short median antero-posteriorly directed groove, while from behind it a similarly directed prominence runs backwards almost to the very postaxial margin of the palate. The middle of that margin in *P. erithacus* projects postaxiad rather more than the parts of the margin right and left of it, because the postaxial concavities for the palatines begin almost at once on either side of it.

In *L. flavopalliatus*, on the contrary, the middle part of the postaxial margin of the palate does not project postaxiad quite so far as does the part of that margin on either side which is mesiad to the concavity for the palatines. Nevertheless in that median part there is a minute process bounded laterally by a very minute notch, these notches together with the process they laterally bound appear in the middle of the postaxial median marginal concavity of the palate.

The free margin of that palate is relatively much more extensive in this species, the part of it interposed between the two surfaces for the palatines being fully equal to the extent of both those surfaces, while in *P. erithacus* it is but about equal to one of them. The postaxiad extensions of the prosopium on either side of the palatines are short, yet a little longer, relatively, than in *P. erithacus*. Thus the palatines do not advance so far forwards into the palatal region of the prosopium in the last-named species.

These lateral prolongations are strongly convex antero-posteriorly in both species, but more so in *P. erithacus*, since in *L. flavopalliatus* (as before said) the jugal process so projects as to produce a concavity towards the postaxial end of the tomial margin. Here also these lateral prolongations may be said to be slightly grooved antero-posteriorly, especially in the anterior portion of each. But in *P. erithacus* these cannot be said to be more than rather flattened.

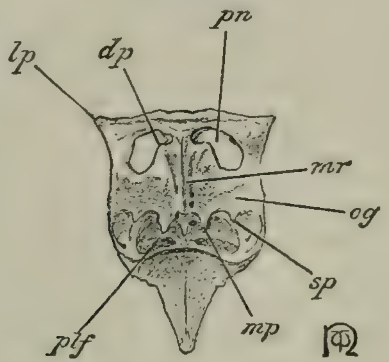
The ventral surface of the prosopium, behind the palate, shows, in both species, a median antero-posterior ridge with a wide concavity on either side of it, in the hinder part of which is a deepish fossa, beneath which the palatine passes forwards and external to which is the fossa for the zygoma. The median ridge projects backwards as a process from the postaxial margin of this postpalatal part of the ventral surface of the prosopium, which margin is otherwise slightly concave. The median ridge is less marked in *L. flavopalliatus* and the surface on either side of it is entire, while in *P. erithacus* it presents a bony network of diploë. This surface is much longer relatively in *L. flavopalliatus.*

THE ANTERIOR ASPECT of the prosopium (see fig. 8, p. 382) is very similar in both species. Its outline approximates to that of an isosceles triangle with the base dorsad—the basal line being very slightly convex and the two lateral lines being convex towards the base and concave (more strongly so in *L. flavopalliatus*) towards the apex. In addition to the distinctive characters given in the description of the general anterior aspect of the skull, the following points may be mentioned:—The nares in *L. flavopalliatus* are more medianly approximated and nearer the uppermost margin of the prosopium than in *P. erithacus*, while the lamella of bone between each nostril and the tomial margin is relatively wider. In the latter the lachrymal process is more marked and projects more outwards. In *L. flavopalliatus* it hardly projects at all outwards, but only backwards. The most considerable difference is the greater extension ventrad of the apex of the prosopium (relatively as well as absolutely) in *P. erithacus.*

THE POSTERIOR ASPECT of the prosopium (which cannot of course be well seen till this part is detached from the cranium) shows, in *P. erithacus*, an irregular surface which rises, at a moderately obtuse angle, from the hinder margin of the postpalatal ventral surface of the prosopium. The median ridge just described as existing on that surface is continued upwards (*mr*) in the middle of the posterior surface with a marked concavity on either side of the vertical grooves, which define, laterally, that ascending median ridge. Externally to this median portion of bone (with its ascending ridge and two lateral concavities) is on either side a large aperture, the two forming the *posterior prosopial nares* (*pn*). Each is an oval aperture, longer than broad and inclining outwards towards its ventral boundary. These nares and the whole prosopium are bounded dorsally by a transverse bar of bone (grooved posteriorly), the outer end of which projects outwards and slightly upwards, forming the *lachrymal process* (*lp*). The outer boundary of the posterior nasal opening is formed by a vertical bar of bone (one of the two external nasal crura) which descends from the lachrymal process and outer end of the dorsal horizontal bony bar, first narrowing downwards and then expanding beneath its lower end in the pit for the zygoma.

Above this is an oblique groove (*og*) running preaxiad and ventrad to below the lateral concave surface before noticed. From the inferior margin of the postaxial surface of the prosopium four processes depend. Two of these (*mp*) may be called median processes, and each is long and sharply pointed and projects ventrad on each side of the median ascending ridge. The other two, lateral or side processes (*sp*), are much shorter and depend one from each of the two oblique grooves (*og*) before described. The two inner margins of the two posterior prosopial nares are formed by the lateral margins of the median osseous

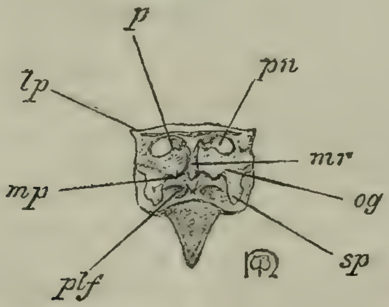
Fig. 4.



Posterior aspect of prosopium of *Psittacus erithacus.*

dp.	Dorsal process.	*plf.*	Fossa for reception of palatine.
lp.	Lachrymal process.	*pn.*	Posterior prosopial nares.
mp.	Median processes.	*sp.*	Lateral processes.
mr.	Median ridge.		
og.	Oblique groove.		

Fig. 5.



Posterior aspect of prosopium of *Lorius flavopalliatus.*

lp.	Lachrymal process.	*plf.*	Fossa for reception of palatine.
mp.	Median processes.	*pn.*	Posterior prosopial nares.
mr.	Median ridge.	*sp.*	Lateral processes.
og.	Oblique groove.		
p.	Dorsal process.		

piece which bears the ascending median ridge and the two concavities on either side of it. Towards the dorsal end of each lateral margin is a short but sharp dorsal process (*dp*), so that a notch is formed on either side of the uppermost part of the median ossification just before it merges into the horizontal osseous bar which forms the dorsum of the hinder aspect of the prosopium.

In *Lorius flavopalliatus* the posterior surface of the prosopium is relatively as well as actually much less dorso-ventrally extended; the posterior nares are more nearly horizontal and much less inclined ventrad externally; the lachrymal processes are shorter and especially less produced dorsad, and the lateral processes are larger (instead of smaller) than the median ones, and descend ventrad much beyond (instead of much less than) the median ones.

II. The Cranium.

The lateral aspect of the cranium (see figs. 1 & 2) shows—in addition to what has been said as to the lateral aspect of the skull as a whole—the following characters. At the dorsal part of its preaxial margin the nasal process of the frontal (*np*) is less conspicuous in *L. flavopalliatus* than in *P. erithacus.* Of the margin of the interorbital septum its dorsal part does not form so marked an angle with the ventral part of it in front of the attachment of the palatines. The preaxial end of the zygoma is less dorso-ventrally expanded. The preaxial margin of the palatine is slightly less, and its ventral margin rather more, concave. The postero-inferior angle is larger and more prominent, while instead of the more or less long postaxial process (*pp*), which in *P. erithacus* projects dorsad and postaxiad from the summit of the postaxial margin of the palatine, there is an exceedingly small one which does not project as much as does the ventral boundary of the postaxial concavity of the bone. The external surface of the palatine is also more concave dorso-ventrally, especially in its hinder half.

Of the dorsal margin of the palatine the part joining the *basis cranii* is about as long, relatively, as in *P. erithacus,* but the part of that margin postaxial to that junction develops two processes towards its postaxial termination.

The orbit is almost bounded infero-externally by bone, the lachrymal extending postaxiad to within a short distance of the sphenotic process (*sph*). Posteriorly, however, the orbit is less encircled by bone at its outer margin, for the postorbital process (*po*) is very much shorter, not projecting at all downwards, and relatively not so much outwards as in *P. erithacus.*

The sphenotic process is also relatively somewhat shorter and notably different in shape, and it does not descend, as in *P. erithacus*, almost to the dorsal margin of the zygoma.

In the latter species it projects forwards and downwards and also a little outwards. It is flattened dorsally and externally, and is longitudinally channelled on its ventral surface, the inner margin of that channel being prolonged into a short pointed process, while its outer margin continues on as the apex of the whole sphenotic process (fig. 7, *sph*, p. 378).

The external margin of that whole process, in *P. erithacus*, is even; no marked process projecting from it outwards and ventrad in front of the ascending process of the quadrate.

In *L. flavopalliatus* the sphenotic process curves a little inwards towards its apex, is flattened externally and dorsally, and ventrally grooved antero-posteriorly. Both the groove and the process from its internal margin are, however, relatively as well as absolutely shorter than in *P. erithacus*—especially the process. A marked difference between the two also exists at its outer border, which, in *L. flavopalliatus*, sends outwards and downwards a marked ecto-sphenotic process, so that the margin of the articular concavity for the quadrate (which appears, in both species, at the hinder end of the external border of the sphenotic process), instead of being slightly marked with no definite anterior boundary, as in *P. erithacus*, appears very marked and is sharply limited anteriorly by the ecto-sphenotic projection (see, in fig. 1, the small process projecting downwards just in front of the summit of the ascending process of the quadrate).

In *P. erithacus* a shallow temporal fossa runs postaxiad and slightly dorsad between the postorbital and sphenotic processes, being bounded preaxially by a marked ridge which descends on the cranial surface from the postorbital process to the inner side of the root of the sphenotic process. The temporal fossa has its dorsal margin defined by a slight ridge, very convex dorsad, which runs postaxiad from the postorbital process. The fossa is limited ventrally by another slightly marked ridge, nearly straight, or only most slightly convex dorsad, which continues on postaxiad the ventral margin of the sphenotic process. These two slightly marked ridges meet at a point as much behind the hinder margin of the auditory meatus as that meatus is broad, and at a little higher level than the uppermost margin of the meatus. At the point where these ridges meet there is a slight prominence which may be distinguished as the postsquamosal prominence (*psp*).

The auditory opening in *P. erithacus* is limited in front only by the ascending process of the quadrate. Its postaxial margin is formed by the anterior edge of the broad postmeatal bony lamella, which edge, or margin, is faintly concave preaxiad at its lower part, but most strongly concave preaxiad at its more dorsal portion.

The meatal opening is bounded above by a narrow bony lamina which extends preaxiad and mesiad (ventrally to the outer margin of the root of the sphenotic process) to bound posteriorly the cup into which the outer articular surface of the head of the ascending process of the quadrate fits. The inner anterior end of the lamina hardly descends at all behind the process of the quadrate, but a marked though short process projects outwards from its middle just above the middle of the auditory opening, which prominence may be distinguished as the suprameatal process (*sm*).

It juts outwards just beneath the ventral margin of the root of the sphenotic process.

The lamella of bone behind the meatus presents a rather wide, somewhat undulating surface, which is bounded dorsally and preaxially by the more postaxial part of the ridge bounding the temporal fossa below, while, more postaxially, it is bounded by a continuation of the same ridge running downwards and slightly backwards (concave forwards) to a junction with the lateral (and descending) part of the lambdoidal ridge, where a slight process or prominence—which may be distinguished as the exoccipital prominence (*ep*)—appears at their junction. From that point the postaxial margin of the postmeatal lamella presents an outline strongly concave backwards till it reaches the apex of the inferolateral part of the lamella, which apex projects outwards, backwards, and somewhat inwards as the *paroccipital process* (*par*).

In *L. flavopalliatus* the conditions are the same, save that the temporal fossa is somewhat smaller relatively as well as absolutely, and that a postsquamosal prominence at the junction of the very slight ridges bounding the fossa dorsally and ventrally is rudimentary. The auditory opening also is limited in front for almost its whole extent by a very delicate lamella of bone which descends behind and close to the ascending process of the quadrate (see fig. 1). The postaxial margin of the aperture is deeply concave for the upper two-thirds of its extent, while beneath this the margin is no longer concave but slightly convex.

The undulating lamella of bone behind the meatus is of a different shape from that of *P. erithacus*, being relatively broader (antero-posteriorly) dorsad and narrowing more rapidly ventrad. The very faintly marked exoccipital prominence is at a slightly higher level, and the postaxial margin of the lamella is nearly straight, extending forwards (preaxiad) as it proceeds downwards till it comes to the root of the paroccipital process (*par*), which is bent more sharply backwards than it is in the last-named species.

The outer surface of the postauditory lamella is somewhat less grooved and concave than in *P. erithacus*, but, as in that species, its ventral part is convex both dorso-ventrally and antero-posteriorly. Its anterior and posterior surfaces meet together as a sharper ridge than in the Grey Parrot.

The quadrate (*q*), as seen in this lateral view of the cranium, instead of having a nearly straight or only slightly convex margin (more than two-thirds the length of its ascending process), as in *P. erithacus*, has in *L. flavopalliatus* a dorsally, very convex margin not half the length of the ascending process. In both, however, it almost continues onwards postaxiad the dorsal margin of the zygoma, that bone articulating with the outstanding (zygomatic) process of the quadrate, which projects to about the same extent, relatively, in both species.

The postaxial margin of the quadrate is in both longer than the dorsal one; but while in *P. erithacus* it is somewhat rounded yet separable from the ventral margin by an obscurely-marked angle, in *L. flavopalliatus* both these margins run indistinguishably one into the other in one continuous curve.

In both species the ventral margin of the quadrate is convex in both directions, corresponding with the elongated articular groove of the mandible.

A second articular surface[1] for the mandible (one which articulates with the inner surface of the articular process of the latter) is situated on the hinder part of the external surface of the quadrate behind and below the externally extending zygomatic process. This surface is strongly concave from without inwards and slightly convex in the opposite direction. The anterior margin of the quadrate has a short, anteriorly concave outline where it joins the pterygoid (*pt*), dorsad of which is a very sharp-pointed process (the orbital process) extending forwards, inwards, and somewhat downwards from just below and in front of the base of the ascending process (see, in fig. 1, the process ascending above the hinder end of the zygoma, and, in fig. 2, above that of the pterygoid).

The zygoma, though nearly straight in both species, is slightly more bent concave dorsally for about its middle third in *L. flavopalliatus*. It is also, even relatively, somewhat more slender, and does not expand dorso-ventrally where it joins the prosopium nearly as much as in *P. erithacus*. Apart from this expansion the zygoma is throughout of nearly the same dorso-ventral and transverse extent in each species. As before said, the sphenotic process does not so nearly touch the zygoma in *L. flavopalliatus*; yet though it is thus relatively shorter, the lachrymal process approaches it much more nearly, diverging very slightly therefrom as it arches backwards, a little outwards, and subsequently upwards. The distance between its apex and that of the sphenotic process is not more than half the distance from the apex of the sphenotic process to the quadrato-zygomatic articulation, while in *P. erithacus* it nearly equals that distance.

The lachrymal narrows very gradually to its apex. This narrowing is more gradual in *L. flavopalliatus*, which also has the apex more truncated and the dorsal margin of the whole process more strongly concave upwards owing to its greater prolongation postaxiad.

The outer surface of the cranium in the lachrymal region in front of the orbit is smooth. The lachrymal is very convex dorso-ventrally down to a point nearly opposite the supra-jugular process of the prosopium. Then it becomes concave in that direction in both species, but the concavity is very marked in *L. flavopalliatus*, assuming the form of an antero-posteriorly directed groove, sharply limited above and below. In *P. erithacus* the same groove exists, but it is very much less marked. Beyond this groove the lachrymal is very slightly convex dorso-ventrally in *P. erithacus*, while in *L. flavopalliatus* it presents a more decidedly flattened surface which looks outwards and somewhat downwards.

The *postero-superior* margin of the palatine is, in both, connected with the *basis cranii* for rather less than half that margin's extent, and at its preaxial end sends forwards a sharply projecting *anterior palatine* process (see p. 378, figs. 6 & 7, two processes behind the end of the line running inwards from the letters *sp*). Behind this attachment it descends backwards with a slightly irregular margin in *P. erithacus*, which runs on into that of a strongly-marked posterior palatine process (fig. 2, *pp*). In *L. flavopalliatus* this part of the postero-superior margin is still more irregular, presenting two blunt processes, one behind the other, and projecting dorsad and postaxiad almost at right angles to the general trend of the palatine. There is, however, only a very minute posterior palatine process (fig. 1, *pp*), which projects from behind the base of the more posterior of the two marginal processes just mentioned.

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[1] See below, p. 391.

The *antero-superior* margin is, in both species, strongly concave, with a foramen (*for*) opening a little behind its middle portion.

The *antero-inferior* margin of the palatine is elongated, slightly concave, and somewhat thickened and rounded in *P. erithacus*. In *L. flavopalliatus* it is relatively, as well as absolutely, shorter, much more concave, and less thickened and rounded.

The *postero-inferior* margin of the bone is the shortest of all in both species, and is strongly concave postaxiad; but in *L. flavopalliatus* this concavity is mainly produced by the prominence of the rounded angle between antero-inferior and postero-inferior margins of the bone, while in *P. erithacus* it is chiefly owing to the great extension backwards of the long and pointed posterior palatine process, which, as before said, is but a minute process in *L. flavopalliatus*.

On the outer surface of the palatine two ridges run, in both species, postaxiad and ventrad, diverging backwards from the base of the anterior-palatine process, the inferior ridge (*p*) going to that of the posterior palatine process.

Ventrad of the lower of these two ridges, the surface in *L. flavopalliatus* is convex in both directions for most of its anterior half, and concave (especially dorso-ventrally so) for slightly more than its posterior half (fig. 1, *p*). In *P. erithacus* this convexity is hardly to be traced, while the concavity just described is less marked.

The most dorsal portion of each palatine is inflected mesiad, and so is much hidden when the cranium is viewed laterally, and can be best perceived when the ventral and inner surface is looked at (figs. 6 & 7). The higher of the above-mentioned two diverging ridges coincides with the line of inflection. The inner surface of the palatine will be noticed when the cranium as seen on its ventral aspect is described.

The divergences, as regards the angles formed by the margins of the palatine with each other, are given after the list of cranial dimensions.

In both species the pterygoid (*pt*), thus laterally viewed, is a slender bar of bone of equal breadth save that it expands slightly at its articulation with the quadrate. It appears below the zygoma in *P. erithacus*, diverging from it very slightly ventrad and postaxiad. In *L. flavopalliatus* it appears, for the most part, above the zygoma.

The side wall of the skull seen laterally within the circle of the parts hitherto described presents the following characters:—

The anterior portion of the inferior margin (preaxiad of the junction with the palatines) does not ascend preaxiad so sharply in *L. flavopalliatus* as in *P. erithacus*, the angle formed by it with the inferior margin of the *basis cranii* being about 155° instead of 140°. The inferior margin behind the junction with the palatines is rather more concave, and its general trend is nearly in a straight line with the line of the palatine attachment, whereas in *P. erithacus* these two lines form an angle of about 160°.

In both species a prominence—the *septal process*—is developed at the anterior end of the antero-inferior margin of the cranium (figs. 6, 7, 9, & 10, *sp*), but it is sharper and more prominent in *L. flavopalliatus* than in *P. erithacus.* In both species the side wall of the skull seen within the orbit consists of an antero-inferior septal part (presenting an almost vertical, slightly undulating surface, bounded above and behind by the olfactory and optic foramina) and a postero-superior surface. The latter inclines outwards and upwards till it reaches the superior margin of the orbit, and presents a smooth surface strongly concave antero-posteriorly and slightly so transversely. It is bounded inferiorly by a transverse ridge (figs. 9 & 10, *tr*, pp. 383, 384), which runs from a point just external to the small foramina beside the optic foramen, outwards to the postorbital process. This ridge is much more marked and distinct in *L. flavopalliatus* than in *P. erithacus.*

Near the postero-inferior angle of the septal part is a slightly-marked concavity, which runs forwards from a small rather deep fossa, which is bounded externally by a small process—lateral eustachian process (figs. 6 & 7, *le*)—which extends forwards to a very slight degree further than the median eustachian process (*me*), which projects preaxiad beneath the eustachian aperture. This fossa is more marked in *L. flavopalliatus* than in *P. erithacus*, but the lateral eustachian process is less sharply prominent.

Above this concavity, between it and the optic foramen, is a marked convexity which extends forwards to a little in front of the latter. This convexity is relatively, as well as absolutely, narrower in *L. flavopalliatus*, and is indeed reduced to a mere rounded ridge passing forwards and slightly upwards to just in front of and beneath the optic foramen. In the superior portion of the septal part there is a concavity just below the large olfactory opening, which is much more marked in *P. erithacus.* In both species, in front of the large aperture just named, a prominent ridge—the *crucial ridge*—runs outwards and forwards from about the middle of the front boundary of the olfactory aperture and bounds the preorbital foramen below, ending at the inferior margin of the lachrymal (figs. 9 & 10, *cr*), and bounds postaxially the concavity last mentioned. The large olfactory aperture at the antero-dorsal part of the septum is subreniform and about twice as long as broad in *P. erithacus.* In *L. flavopalliatus* it is more rounded.

THE DORSAL ASPECT of the cranium (see fig. 3, p. 367) shows, in both species, a surface which is convex both antero-posteriorly and transversely. It is, however, much flattened between the orbits. In *L. flavopalliatus* there is a slight though marked depression in the hinder part of the interorbital region, which is hardly to be detected in *P. erithacus*, while in the latter species there may be a median longitudinal depression in the parietal region which does not exist in *L. flavopalliatus.* In both the dorsal surface of the cranium may be said to be bounded by ten margins.

The first or preaxial margin is that which adjoins the prosopium, and is on the whole very slightly concave.

The second and third margins (the two preorbital margins) each proceed outwards and postaxiad from one outer end of the first (prosopiad) margin to the preorbital prominence of the same side, and each is about half as long as is the lateral margins of the prosopium. The two preorbital margins diverge postaxiad at an angle of about 95° in *L. flavopalliatus* and of about 80° in *P. erithacus.*

The fourth and fifth margins form the anterior part of each orbital margin (each anterior orbital margin), while the sixth and seventh margins of the dorsum of the cranium constitute the posterior part of each orbital margin (each posterior orbital margin). The anterior and posterior orbital margins meet at a marked angle of about 120°, the apex of which is a little in front of the middle of each orbit's margin. In *P. erithacus* they run into each other in a curve with only a faint indication of an angle of about 140°, and this is at approximately the middle of each total orbital margin.

An axial groove, rather wide and shallow, runs along each side of the dorsum of the cranium within the orbital margin, the two grooves being separated by the moderate transverse convexity of the interorbital region. There is a series of foramina in each groove, which is more marked in *P. erithacus* than in *L. flavopalliatus.*

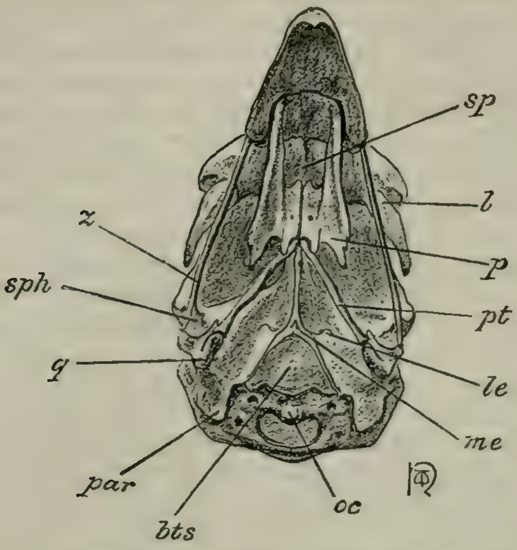
The eighth and ninth margins of the cranial dorsum (the two temporal margins) extend from the postorbital prominence to the outer end of the lambdoidal ridge of either side. Each presents a sigmoid curvature, concave behind the postorbital prominence and then convex in the squamosal region, external to which the suprameatal process, the posterior end of the zygomatic process of the quadrate, and the hinder end of the zygoma may appear.

The tenth, or occipital, margin presents in both species a gentle convex curvature with a small median concavity.

THE VENTRAL ASPECT of the cranium exhibits, in both species, a roughly quadrilateral outline, the smallest margin of which is preaxial and corresponds with the postaxial margin of the prosopium. The lateral sides are the longest and coincide with the zygomata (*z*) and quadrates (*q*), while the hinder margin is convex and formed by the occiput. The palatines (*p*) extend forwards much beyond its anterior margin, and each preorbital prominence projects outwards beyond the preaxial third of the zygoma.

In the middle of the anterior part of the *basis cranii* is a rather elongate space, bounded in front by the postaxial margin of the

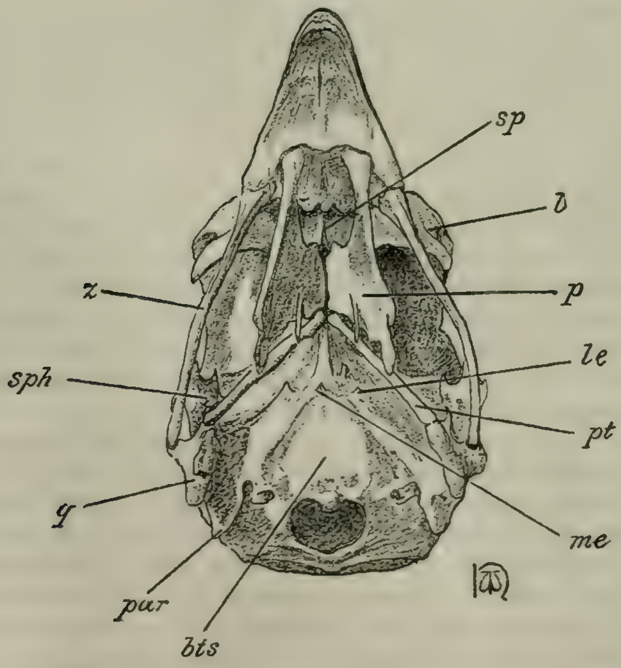
Fig. 6.



Ventral aspect of skull of *Lorius flavopalliatus.*

bts.	Basi-temporal shield.	*par.*	Paroccipital process.
l.	Lachrymal.	*pt.*	Pterygoid.
le.	Lateral eustachian process.	*q.*	Quadrate.
me.	Median eustachian process.	*sp.*	Septal process.
oc.	Occipital condyle.	*sph.*	Sphenotic process.
p.	Palatine.	*z.*	Zygoma.

Fig. 7.



Ventral aspect of skull of *Psittacus erithacus.*

(Lettering the same as in fig. 6.)

prosopium and laterally, and also postaxially, by the palatines. The anterior and larger portion of the roof of this space is formed by the postpalatal ventral surface of the prosopium; behind the hinder margin of this surface it is roofed by the *basis cranii.*

This part of the ventral surface of the cranium shows in *L. flavopalliatus* a median, triangular raised surface narrowing backwards and traversed antero-posteriorly by a slightly marked ridge. Externally this surface is a groove widening backwards, with a perforation at its hinder end for the olfactory nerve. Postaxially each of these fossæ is limited by a transverse ridge—the crucial ridge (figs. 9 & 10, *cr*). Beneath the anterior part of the fossa a sharp uncinate process projects inwards, and, at its apex, somewhat backwards.

In *L. flavopalliatus* the dorsal portion of each palatine is bent mesiad to meet the corresponding part of the other palatine much more sharply than in *P. erithacus*, so that when the *basis cranii* is looked at these bent-in portions of the two palatines present a considerable extent of flattened surface almost equalling that of the hinder margin of the bony palate between the two palatines. Moreover, each bent-in part forms internally almost a right angle with the vertical main portion of the bone, while externally (or dorsally) the angle is yet more marked. In *P. erithacus* each palatine gently curves to meet its fellow, so that there is hardly any ventral flattened surface, while internally the median part forms a very obtuse angle with the vertical main portion of the bone, though externally (or dorsally) the angle is very marked and the dorsal surface is flattened and transversely concave. Thus the inner and outer surfaces of the palatine correspond in neither species.

From the inner end of the anterior margin of each palatine an anterior palatine process[1] extends forwards beside its fellow of the other palatine. These are less marked in *P. erithacus*, and they are not side by side but diverge more forwards, so leaving a greater gap between them. On the other hand, this species has (as before mentioned) long posterior palatine processes which are wanting in *L. flavopalliatus*. In the latter there are two postaxial processes, one on side of the posterior end of the mid-junction of the palatines, so that the postaxial margin of the two conjoined palatines presents three concavities instead of only one as in *P. erithacus*, though a delicate styliform process extends backwards from the ventral and inner surface of each palatine to beyond its postaxial margin.

In both species the pterygoids (*pt*) diverge from the middle of the hinder margin of the palatines and the rostrum of the *basis cranii*, with which latter, however, they do not articulate.

The palatine, the pterygoid, and the zygoma of each side bound a triangular space wherein is seen the roof of the orbit. The great olfactory opening is hidden (in this view) by the palatines. In the front of each of these triangular spaces is seen the junction of the prosopium with the cranium and the part behind it (just described), only the crucial ridge is almost entirely concealed by the palatines. Into the posterior angle of this triangular space the sphenotic process (*sph*) is seen to project in *P. erithacus* but hardly in *L. flavopalliatus.*

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[1] See above, p. 375, the first three lines.

The zygoma arches outwards most at a little behind its antero-posterior middle in both species.

The preorbital prominence also projects outwards beyond the anterior half of the zygoma, and between the latter and the outer margin of that process the lachrymal is seen extending backwards and slightly outwards to about the hinder end of the anterior three-fourths of the zygoma in *L. flavopalliatus*, and to about the hinder end of its first third in *P. erithacus.*

The quadrate (*q*) in the last-named species presents, thus viewed, a roughly triangular surface, with one margin mesiad (postaxiad from the attachment of the pterygoid), another externad and postaxiad, and the third (between the attachments of the zygoma and pterygoid) preaxiad and externad. The last is strongly concave, the second very slightly so, while the first is nearly straight and forms the inner margin of the elongated convex articular surface for the long articular concavity of the mandible.

The quadrate of *L. flavopalliatus* only differs in that the second margin is relatively as well as absolutely shorter, the quadrate (as before mentioned) extending so much less backwards behind its attachment to the zygoma. The angle formed by the first and second margins is also much more obtuse than in *P. erithacus.*

The hindmost boundary of the ventral aspect of the cranium is, in both species, formed by the lambdoidal ridge. In front of this is the occipital region, bounded anteriorly by the occipital condyle and two lines proceeding thence to the two paroccipital processes. Medianly there is visible a median prominence (which is one running dorsad from the middle of the dorsal margin of the foramen magnum) and a depression on either side of it. The prominence is rather more marked in *L. flavopalliatus* than in *P. erithacus.*

The deep cleft between the quadrate and the end of the paroccipital process is absolutely as well as relatively greater in *L. flavopalliatus* than in *P. erithacus*, while the quadrate does not extend backwards so far, and is relatively much more distant from the hinder end of the paroccipital process.

Just in front of the condyle is a small fossa which is very much more marked in *L. flavopalliatus.* In front of this again, in the same species, is a transverse zigzag ridge which bounds postaxially the basi-temporal shield (*bts*). This ridge has the shape of the letter **M** with extremely wide angles, the median angle being postaxiad and forming the antero-inferior boundary of the small precondyloid fossa just mentioned. Each lateral end of the ridge bounds the jugular foramen anteriorly—the vagal foramen opening just above it—and joins a ridge bounding laterally (on the same side) the basi-temporal shield (*bts*).

In *P. erithacus* this transverse ridge is very indistinct and not **M**-like, and presents four small postaxiad prominences on about the same transverse line, while the two external ones probably answer to the lateral ends of the **M**-like ridge of *L. flavopalliatus* because a vagal foramen opens just above each of them.

In this species there is on either side of the cranium a roughly quadrilateral space bounded anteriorly by the outer end of the posterior transverse basi-temporal ridge, internally by the lateral margin of the foramen magnum, externally by the paroccipital process, and posteriorly by a rounded prominence (exoccipital prominence) running from the summit of the side margin of the foramen magnum to the posterior surface of the paroccipital process. In *P. erithacus* the conditions are similar save that the exoccipital prominence is somewhat less pronounced and ridge-like. In both species a foramen opens on the exoccipital prominence about midway between the margin of the foramen magnum and the base of this paroccipital prominence, but this foramen is larger and very much more conspicuous in *L. flavopalliatus*.

The side of the paroccipital process bounding this quadrilateral space (the inner aspect of the process) has in both species a conspicuous foramen opening into it.

The infero-external aspect of this process is very different in the two species. In *L. flavopalliatus* it is wide, strongly concave transversely, and looks mainly downwards. In *P. erithacus* it is but slightly concave transversely and looks more outwards.

The posterior end of the paroccipital process in *L. flavopalliatus* is bent more sharply backwards than in *P. erithacus* and also somewhat inwards (see figs. 1 & 2 and 9 & 10).

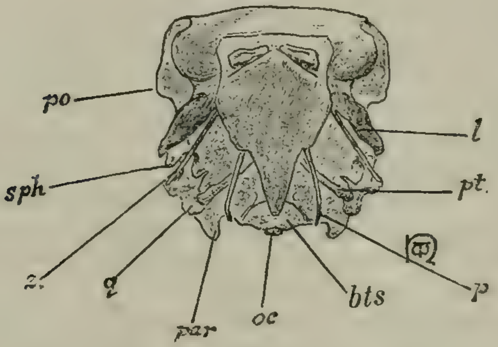
The basi-temporal shield is limited laterally by two very sharply raised ridges, which meet together just below the eustachian aperture and end in a median sharp-pointed process projecting forwards beyond and beneath it (fig. 6, *me*). Between its lateral and postaxial ridges the shield is smooth and slightly concave, without ridges or foramina.

In *P. erithacus* its lateral ridges are much less well-defined and are represented by two slightly elevated prominences each of which is marked by a very narrow longitudinal groove, but the shield also ends medianly in front in a pointed eustachian process (*me*) projecting forwards beneath the eustachian opening. The surface of the shield is slightly undulating, and a little behind the eustachian process is a depression behind which there may be a median ridge.

In *L. flavopalliatus* there is outside each lateral basi-temporal ridge a wide transverse concave surface which becomes continuous posteriorly with the ventral surface of the paroccipital process. It is bounded superiorly and externally by a slight ridge running forwards and inwards from just below the foramen ovale and ending in a small preaxiad process—the lateral eustachian process (fig. 6, *le*). In *P. erithacus* this concave surface is narrower and does not approach so nearly the foramen ovale, while the ridge bounding it superiorly and externally ends in a more marked lateral eustachian process (fig. 7, *le*).

In front of the eustachian foramen and just above it begins the rostrum of the *basis cranii*, which gets sharper as it advances forwards to its junction with the palatines. On each side of its hinder part is a marked fossa which runs backwards to beneath the lateral eustachian process, while three small foramina open into it. In *P. erithacus* these two fossæ are much less marked.

Fig. 8.



Preaxial aspect of skull of *Lorius flavopalliatus*.

l. Lachrymal.
bts. Basi-temporal shield.
oc. Occipital condyle.
p. Palatine.
par. Paroccipital process.
po. Postorbital process.
pt. Pterygoid.
q. Quadrate.
sph. Sphenotic process.
z. Zygoma.

The anterior aspect of the cranium is mainly hidden by the prosopium. The frontal region is visible above it, the lachrymal beside it, more externally the lower part of the hinder wall of the orbit and the postorbital process (*po*).

Beneath the prosopium the palatines descend and diverge for a space about equal to that which exists between the spot where either one of them begins to be hidden by the prosopium and the nearest point of the margin of the nares.

External to the palatines, the pterygoids are seen diverging, at a much more open angle, to the quadrate, while from the external process of each quadrate the zygoma is seen ascending to the side of the prosopium.

Medianly and inferiorly the basi-temporal shield is visible between the diverging palatines.

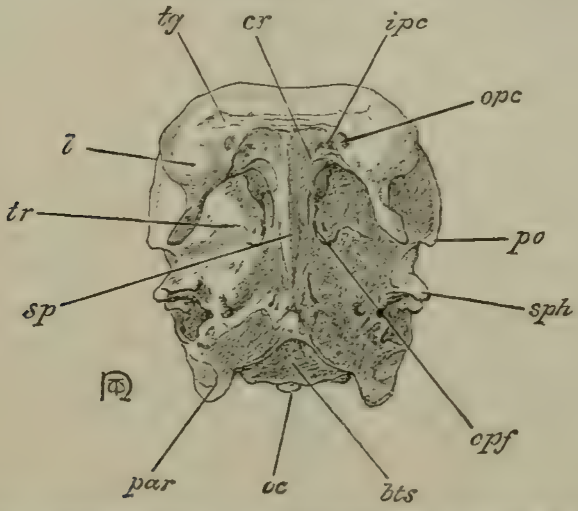
In *P. erithacus* the frontal region seems to rise above the prosopium for a space about equal to that between the posterior margin of the prosopium (thus seen) and the anterior margin of the bony nostrils, while the breadth of each of the latter is about equalled by that of the broadest part of the lachrymal. The palatines diverge at an angle of about 25°, and the pterygoids at one of about 97°. The paroccipital processes are visible just within each quadrate.

In *L. flavopalliatus* the frontal is rather less visible, but the lachrymal is broader, especially at the dorsal margin of the external lachrymal groove. Its greater length causes it also to be more visible alongside of the zygoma.

The paroccipital processes are much more visible than in *P. erithacus*, and descend, very decidedly, below the quadrates. The palatine and pterygoid angles are much as in *P. erithacus*.

When the quadrate is removed we find, in both species, that the glenoid fossa of the squamosal is visible at the root of the ventral surface of the sphenotic process. Within this is a narrow rough surface which separates the glenoid fossa from the smaller, more internal, fossa of the pro-otic, which serves for the articulation of the inner tubercle of the quadrate.

Fig. 9.



Anterior aspect (prosopium being removed) of *Psittacus erithacus*.

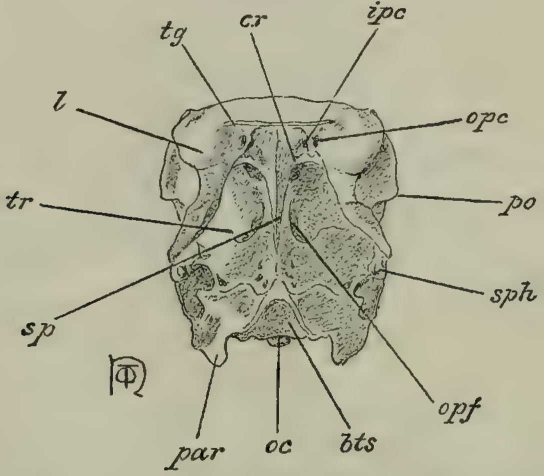
bts.	Basi-temporal shield.
cr.	Crucial ridge.
ipc.	Inner precranial foramen.
l.	Lachrymal, forming the pre-orbital prominence.
oc.	Occipital condyle.
opc.	Outer precranial foramen.
opf.	Optic foramen.
par.	Paroccipital process.
po.	Postorbital process.
sp.	Septal process.
sph.	Sphenotic process.
tg.	Transverse groove.
tr.	Transverse ridge.

On the removal of the prosopium, the anterior aspect of the cranium shows medianly, in *P. erithacus* (fig. 9), the prominence of the base of the cranial septum, with the slightly marked septal process (*sp*). On either side of this median keel are the large olfactory apertures.

Dorsad is the surface of the frontal and beneath it the transverse groove (*tg*) for the dorsum of the prosopium, the fossæ at the outer ends of which receive its lachrymal processes. Beneath these two fossæ is the swollen preaxial surface of the lachrymal (*l*) with its depending process transversely grooved externally. Within the lachrymal on each side, and just mesiad of the fossa for the lachrymal process, is a foramen—the *outer precranial foramen* (*opc*)—separated by a ridge from the fossa before described[1] as bounded postaxially by the crucial ridge, and beneath it the crucial ridge (*cr*) is plainly to be seen passing outwards from the cranial septum to the adjacent surface of the lachrymal. At the bottom of this fossa is (*ipc*) the *inner precranial foramen.*

External to the distal end of the lachrymal on either side is the postorbital process (*po*), beneath which is the notch interposed between it and the sphenotic process (*sph*). Passing inwards from the postorbital process to the vicinity of the optic foramen (*opf*), the transverse ridge before noticed[1] (*tr*) is to be seen. Finally between the paroccipital processes is the basi-temporal shield (*bts*), beneath the middle of which is the prominence of the occipital condyles (*oc*).

Fig. 10.



Anterior aspect (prosopium being removed) of *Lorius flavopalliatus.*

(Lettering the same as in fig. 9.)

In *Lorius flavopalliatus,* thus seen, the transverse groove is shorter, the lachrymal is notably longer, and the paroccipital processes are narrower, less blunt and rounded distally, and more inclined mesiad; the basi-temporal shield is also relatively as well as actually narrower from side to side.

THE POSTERIOR ASPECT of the cranium presents, in *P. erithacus,* a dorsal margin which is very convex on either side but slightly concave in its middle. Laterally its outline is mainly straight and vertical with certain projections: these are, above, the postorbital margin ending in the postorbital process, beneath which is a small sharply marked concavity limited below by the projection of the suprameatal process. Just below this, again, is another concavity (as sharp as, though shorter than, the preceding one) which coincides with the uppermost (and most concave) part of the postaxial margin of the external auditory meatus. Below this, again, is the nearly straight lower part of this margin, which inclines slightly inwards as it descends, and is bounded inferiorly by the sudden out-jutting of the zygomatic process of the quadrate for the zygoma together with the posterior end of the latter. Below this is the lateral outline of the quadrate, which is nearly straight and vertical to the rounded inferior end of that bone.

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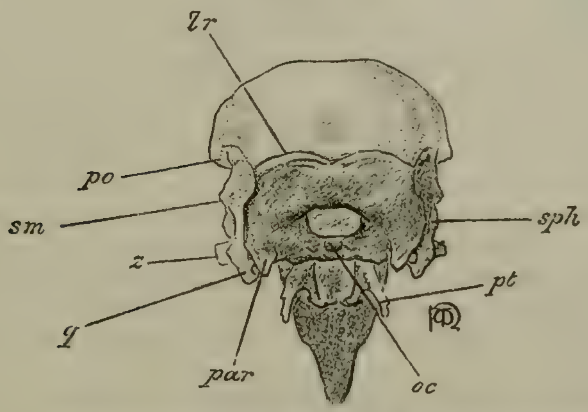
[1] See above, p. 376.

In *L. flavopalliatus* the median concavity of the dorsal margin is less marked; the lateral margin is generally similar to that of the other species save for the much less, relative as well as absolute, extent of the part formed by the quadrate below its zygomatic process, and that the sphenotic process (*sph*) is seen projecting outwards beyond the posterior margin of the external auditory meatus. The suprameatal process (*sm*) projects sharply outwards.

Fig. 11.



Postaxial aspect of skull of *Lorius flavopalliatus.*

lr.	Lambdoidal ridge.	*q.*	Quadrate.
oc.	Occipital foramen.	*sm.*	Suprameatal process.
par.	Paroccipital process.	*sph.*	Sphenoidal process.
po.	Postorbital process.	*z.*	Zygoma.
pt.	Palatine.		

The inferior margin of the cranium, thus seen, is, in *P. erithacus*, formed externally by the two zygomatic processes of the quadrate. Next within comes the inferior border of each quadrate, and then that surrounding the deep and sudden notch which divides each quadrate from the paroccipital process, which does not descend as much as does the quadrate. The median part of the inferior margin (apart from the palatines) presents a low arch medianly interrupted by the projection downwards of its keystone—the basi-occipital with its condyle.

This margin in *L. flavopalliatus* is similar save that the paroccipital processes descend almost as much as do the quadrates.

On this view the palatines are seen descending and diverging at an angle of about 23° in *P. erithacus*, and at a slightly more open angle in *L. flavopalliatus*.

In *P. erithacus* the lambdoidal ridge traverses the posterior surface of the skull a little below its dorso-ventral middle. Above this the occiput is rounded.

This lambdoidal ridge is met (as before noted) by the posterior continuation of the ridge which bounds the temporal fossa inferiorly, and at the point of junction develops an obscurely marked prominence we have called the squamosal prominence (see fig. 2, *psp*). Thence a slightly marked ridge descends vertically to another small prominence or exoccipital process. From this latter another very slightly marked ridge—the occipital ridge—passes inwards and upwards till it nearly joins the lambdoidal ridge, and thus a triangular surface becomes defined. Then this slight occipital ridge continues on inwards and downwards till it meets a prominence running upwards from the middle of the dorsal margin of the foramen magnum to the lambdoidal ridge, or may descend to the margin of that foramen, and thus a second triangular surface becomes defined. Beneath the occipital ridge there is, on each side of the median occipital protuberance, a rather extensive but shallow concavity.

In *L. flavopalliatus* the lambdoidal and occipital ridges are both about equally, and only very slightly, prominent and so close together that only a faint and narrow groove runs between them. The squamosal prominence is very slight, and the exoccipital process hardly to be detected. The median rounded occipital prominence is much more marked, and so is the concavity on either side of it, but the degree of concavity is more uniform over this concave space than in *P. erithacus* and is most marked just below the occipital ridge.

In *P. erithacus* each paroccipital process is somewhat pyramidal, but may be said to present two surfaces limited by a ridge which extends backwards from the hind end of the ridge bounding laterally the basi-temporal shield to the apex of the process, and thence upwards and slightly outwards, finally curving inwards to the exoccipital process.

The outer surface of the paroccipital process is slightly convex transversely and very slightly concave in the opposite direction. The inner surface is very strongly convex transversely and medianly concave dorso-ventrally. The process is bent much backwards (but hardly inwards) towards its apex.

In *L. flavopalliatus* it presents more exclusively two surfaces, the ridge which divides them from each other being sharper. It is so bent that what corresponds to the outer surface of the process in the other species here looks mainly downwards. It is also concave both transversely and antero-posteriorly. The opposite surface looks mainly upwards and is strongly convex transversely at the root of the process, but concave in the opposite direction, especially towards its apex.

The process is bent rather more inwards than in *P. erithacus*, and very much more strongly and sharply backwards.

The *quadrate* in *P. erithacus* has its columnar process long and stout. At its apex is a large external and smaller internal articular surface separated by a narrow groove.

Its orbital process is short, delicate, and pointed (see fig. 2, p. 364), arching forwards and inwards just above the pterygoid. A short but deep concavity separates it from the anterior end of the inferior surface of the quadrate, which there projects forwards, developing a small rounded condyle (separated slightly from the anterior end of the long articular surface, or elongated condyle for the mandible) which fits into cup of hinder end of pterygoid.

The zygomatic process presents ventrad an outer articular surface in the form of an antero-posterior convexity and a slight transverse concavity to articulate with the mandible dorso-laterally. This is the part of the quadrate which articulates with the upper articular surface of the mandible, while the elongated ventral condyle of the quadrate articulates with the long concave inferior articular surface of the mandible. The inferior articular surface of the quadrate is elongated and nearly straight (slightly concave mesiad), extending forwards and inwards on a line with the pterygoid which is in front of it. Above it is the little condyle for the cup of the pterygoid above-mentioned. In both species the elongated condyle for the mandible is larger at its anterior end, but more predominantly so in *P. erithacus*. Just above its anterior end is the articular convex surface for the pterygoid, while in front of the apex of the zygomatic process is a small cup to receive within it the end of the zygoma.

The extent of the body of the quadrate behind the zygomatic process is longer than that in front of it to the front margin of the base of the ascending orbital process, and the depth from the zygomatic process about equals the length thence to the apex of the orbital process. In both species the hinder margin of the quadrate is continuous and does not develop any strongly projecting process.

In *L. flavopalliatus* the ascending columnar process is relatively longer and more slender. The extent of the quadrate behind the zygomatic process is also shorter than that in front of it to the front margin of the base of the orbital process, and its depth from the apex of the zygomatic process is shorter than from that point to the apex of the orbital process,—the inferior and still more the hinder portion of the quadrate being, relatively as well as absolutely, much smaller than in *P. erithacus*.

III. THE MANDIBLE.

The symphysial portion of the dentary part of the mandible externally, is nearly straight antero-posteriorly (*i.e.* dorso-ventrally) in *L. flavopalliatus* but gently convex in *P. erithacus*. In both it is decidedly convex transversely, but it presents a broadened-out gentle convexity in the latter species, while in the former (fig. 14, p. 390) it is narrower and sharper and therefore more convex. In both the symphysial convexity passes smoothly into the relative flatness of the adjacent external surfaces of the beak-bearing parts of the lateral rami, without any dorso-ventral ridges dividing it from the latter. The front, or external, surface of the symphysis is beautifully marked with vascular grooves in *P. erithacus* and less so in *L. flavopalliatus*. The apex of this surface is dentated or somewhat irregularly serrated in both, but the transverse extent of this serrated margin is less relatively as well as absolutely in *L. flavopalliatus*. In *P. erithacus* there is a depressed transverse area (·7 mm. long × ·12 broad) just below the serrated margin and a number of small foramina open into this area (see fig. 19, p. 393). In *L. flavopalliatus* there is no such depressed area, though there are small foramina close to the dorsal margin of the mandible.

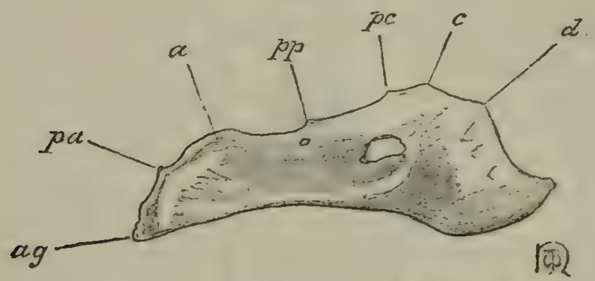
At a short distance from the dorsal margin, two small foramina open on either side of the symphysis, the two pairs being about as distant from each other as from the dorsal margin of the mandible. They are relatively much nearer the dorsal than the postero-ventral margin of the mandible in *L. flavopalliatus*, because in that species the symphysis is so much longer compared with the total antero-posterior extent of the mandible. From each pair of foramina a groove runs backwards and inwards till it meets its fellow of the opposite side, from which point a single groove runs downwards and backwards to the middle of the postero-inferior symphysial margin. Thus a **Y**-shaped groove is formed. The two upper arms of the **Y** meet at a much more open angle in *P. erithacus* than in *L. flavopalliatus*. Their point of junction also in the former species is at about the dorso-ventral middle of the symphysis, while in the latter it is distant from the postero-inferior margin only one-third of the total dorso-ventral extent of the symphysis.

When the mandible is viewed laterally, its supero-anterior margin presents, in *P. erithacus*, a strongly marked concavity bounded in front by the apex of the mandible and postaxially by an obscurely marked process I have called the dentary process (*d*). The process is still less marked in *L. flavopalliatus*, while the concavity between it and the mandibular apex is but slight and so presents a great contrast to that part in the other species. In both, a faintly marked more or less undulating ridge proceeds downwards and backwards from the dentary process to the ventral margin of the ramus, and this marks the limit of the postaxiad extension of the bony beak.

The posterior margin of the symphysial portion of the mandible is very different in the two species. In *P. erithacus* (fig. 17) it is in the form of a pointed arch, neither acute nor obtuse, but in *L. flavopalliatus* it is a very open elliptical arch and less strongly concave (see figs. 16 & 14). Its middle point is relatively very much nearer one between the anterior ends of the inferior articular surfaces, because the symphysis is relatively so much longer in this species.

The postero-superior surface of the symphysis is strongly concave transversely, but only very slightly so antero-posteriorly in both species, indeed in *L. flavopalliatus* it would be almost perfectly straight but for the fossa for the geniohyoid and the transverse prominence in front of it. A faintly marked curved line (convex postaxiad in *P. erithacus* with a sigmoid flexure, concave postaxiad above and convex postaxiad below in the other species) descends—from the dentary process in *P. erithacus*, from behind the dentary process in *L. flavopalliatus*—to the dorsal margin of the fossa for the genioglossus (*gg*). This fossa is much more marked in *L. flavopalliatus*, and, on account of the length of the symphysis, relatively nearer the postaxial margin of the bone. In *P. erithacus* it is twice or more as distant from its anterior margin as from the posterior one, and it is bounded supero-anteriorly by an arched ridge, concave backwards, just beneath which are one or two vascular foramina. The fossa is wider and more shallow than in *L. flavopalliatus*, and bounded infero-posteriorly by a bony ridge which constitutes the postero-inferior margin of the symphysis (see figs. 16 & 17). In *L. flavopalliatus* it is bounded supero-anteriorly by a very delicate lamina of bone, in front of which is a rather wide transverse prominence convex antero-posteriorly. Behind the fossa there is a smooth portion of bone intervening between it and the postaxial margin of the symphysis.

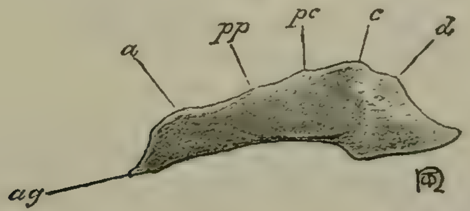
Fig. 12.



Lateral aspect of mandible of *Psittacus erithacus*.

a. Articular prominence.
ag. Angular process.
c. Coronoid process.
d. Dentary process.
pa. Postarticular process.
pc. Postcoronoid process.
pp. Prearticular process.

Fig. 13.

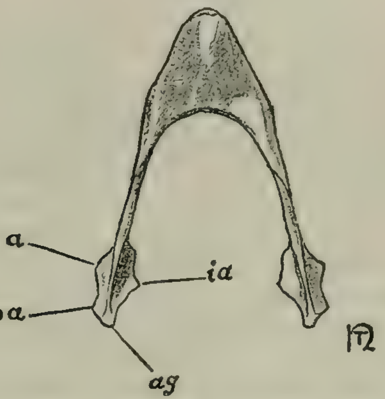


Lateral aspect of mandible of *Lorius flavopalliatus*.

(Lettering the same as in fig. 12.)

The ramus is deepest at the coronoid process (*c*) in both species, thence it gradually narrows postaxiad in *P. erithacus*, but more gradually still in *L. flavopalliatus*, the dorsal and ventral margins of the ramus inclining towards each other at an angle of about 16°, while in *P. erithacus* the angle is about 15°. The dorsal margin behind the dentary process is nearly straight and somewhat inflected in the last-named species, but decidedly though slightly concave in *L. flavopalliatus* and not inflected, and the outer surface of the ramus is scarcely convex from above downwards, but is rather strongly so in *P. erithacus* (a little below the dorsal margin at this part), and, to a less degree, from before backwards.

Fig. 14.



Ventral aspect of mandible of *Lorius flavopalliatus*.

a. Articular prominence.
ag. Angular process.
ia. Internal articular process.
pa. Rudiment of a postarticular process.

The margin between the dentary and coronoid processes is relatively much shorter in *L. flavopalliatus* and (when the mandibles rest on a horizontal surface) is more upwardly inclined postaxiad. In both there is a small postcoronoid process (*pc*)—it may be almost obsolete in *P. erithacus*,—but the margin between it and the coronoid is relatively longer and less concave in *L. flavopalliatus*. The margin extending thence to the slightly marked prearticular process (*pp*) is almost straight in both, but slightly more concave as well as longer in *P. erithacus*. Between the prearticular process and the articular prominence (*a*) the margin is slightly concave in both; very slightly more so in *P. erithacus*. The articular prominence is about equally developed in both species, but while in the last-named species there is a distinct though very small postarticular process (*pa*), whence the postaxial margin of the mandible inclines very steeply backwards to the angular process, in *L. flavopalliatus* there is no postarticular process, or but a trace of it, and the hinder margin slopes very gently to the angular process (*ag*), forming an angle of about 40° with the posterior part of the inferior margin of the ramus instead of one of about 60° as in *P. erithacus*.

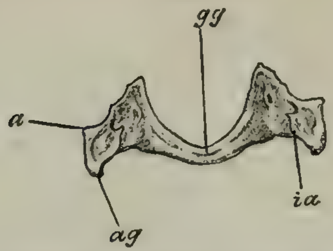
On the outer surface of the ramus there are in both species some small foramina, and a rather conspicuous one in *P. erithacus*. In that species also there is a considerable oval vacuity, or defect of ossification, at about the middle of the ramus dorso-ventrally, the middle of the vacuity being beneath the post-coronoid process. In *L. flavopalliatus*, however, the ramus is here entire but somewhat depressed or concave in this region. This depression is limited behind by a ridge which runs obliquely downwards and forwards from the articular process to the ventral margin of the ramus. This is only represented in *P. erithacus* by a prominence which runs downwards and forwards from the articular process for about half the breadth of the ramus. In *P. erithacus* a small foramen opens beneath the prearticular process at about one-fourth of the dorso-ventral diameter of the ramus from its dorsal margin. In *L. flavopalliatus* it opens a little behind that process and nearer the dorsal margin. Its external surface towards the angular process is slightly concave in both species, rather more so in *L. flavopalliatus*.

In *L. flavopalliatus* the inner surface of each ramus presents two elongated concavities separated by a ridge. At its anterior end this ridge curves sharply upwards, being also there most prominent, and approaching near to the coronoid process. Just behind its upwardly bent part a conspicuous foramen leads into the substance of the mandible. At its posterior end this ridge joins the outer margin of the larger articular surface for the quadrate, at the same time bounding externally a small but deep fossa which is situated outside the front part of that surface. In *P. erithacus* the conditions are similar save that the ascending anterior part of the ridge is the most conspicuous and ascends completely to the coronoid process, and that the foramen behind it is less conspicuous, opening on the front margin of the defect of ossification (which interrupts the internal longitudinal ridge); when the defect of ossification is smaller, the foramen opens beneath it. In both species the small foramen beneath or near the prearticular process opens into the superior longitudinal concavity of the inner surface of the ramus.

In both species also the larger articular surface for the quadrate is in the form of an antero-posterior, nearly straight groove. This groove is broadest at its anterior end in *P. erithacus*, but hardly at all broader there in *L. flavopalliatus*. On its inner side there is a small surface of bone, broadening gradually backwards, at the hinder end of which is a foramen. This is the innermost part of a subquadrate bony process, the internal articular process (*ia*), which projects nearly horizontally inwards and supports the outer part of the longitudinal articular groove.

The smaller and superior articular surface for the quadrate (*sa*) is on the inner side of the somewhat everted coronoid process. It is nearly straight antero-posteriorly, but strongly convex dorso-

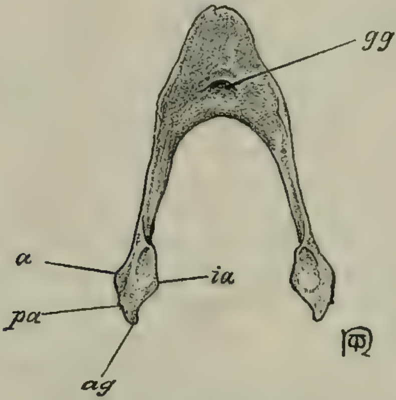
Fig. 15.



Postaxial aspect of mandible of *Lorius flavopalliatus.*

a. Articular prominence.
ag. Angular process.
gg. Fossa for genioglossus.
ia. Internal articular process.

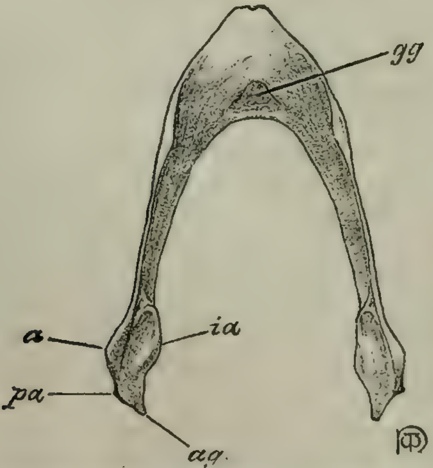
Fig. 16.



Dorsal aspect of mandible of *Lorius flavopalliatu*

a. Articular prominence.
ag. Angular process.
gg. Fossa for genioglossus.
ia. Internal articular process.
pa. Postarticular process. (Quite rudimentary in this species.)

Fig. 17.

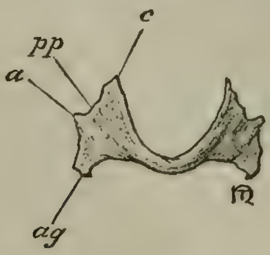


Dorsal aspect of mandible of *Psittacus erithacus.*
(Lettering the same as in fig. 16.)

ventrally. This is the surface which articulates with part of the zygomatic process of the quadrate as before described[1].

From beneath the hinder end of the internal angular process a strong ridge runs backwards, downwards, and outwards to the angular process (*ag*). The apex of this process is bent more inwards in *P. erithacus* and is relatively shorter. It is longer and its dorsal surface presents more of a concavity in *L. flavopalliatus*.

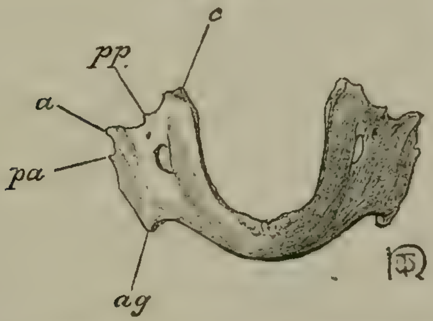
Fig. 18.



Preaxial aspect of mandible of *Lorius flavopalliatus*.

a.	Articular prominence.	*pa.*	Postarticular process.
ag.	Angular process.	*pp.*	Prearticular process.
c.	Coronoid process.		

Fig. 19.



Preaxial aspect of mandible of *Psittacus erithacus*.

(Lettering the same as in fig. 18.)

The mandible viewed in front shows the antero-dorsal margin in *L. flavopalliatus* in the form of an inverted pointed arch, an angular process extending much ventrad, and an apparently very slender transverse bony bar at the symphysis. In *P. erithacus* this bar is much stouter, the angular process less extended ventrad, and the antero-dorsal margin resembles an elliptical arch inverted; the defect of ossification in each ramus is also conspicuous.

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[1] See above, p. 374.

Dimensions of the Skull.

	Lorius.	*Psittacus.*
Length of prosopium from its apex to the middle of the joint which unites it with the cranium (measured along its dorsal curvature)	2·9	4·0
The same measured in a straight line	2·5	3·4
Length of cranium from cranio-facial joint to the mid-dorsal margin of the foramen magnum (measured along its dorsal curvature)	5·1	6·0
The same measured in a straight line	3·6	4·2
Length from apex of prosopium to middle of hinder margin of bony palate	1·4	1·8
From middle of one maxillo-palatine junction to hinder end of lateral margin of prosopium of the same side	·7	·7
Breadth of palate at line of maxillo-palatine junctions	1·0	1·4
Breadth of cranio-facial hinge-joint on dorsum of skull	1·2	1·7
Length from apex of prosopium to its lateral notch (measured along the curve)	·8	1·2
The same measured in a straight line	·7	1·0
Length from lateral notch to hinder end of lateral margin of prosopium	1·2	1·4
Its greatest height of bony beak	1·1	1·4
From its ventral margin to nearest margin of nasal opening vertically above it	·7	·9
Height of its dorsum above the dorsal margin of the nasal aperture	·05	·05
Antero-posterior extent of nasal aperture	·55	·6
Measurement at right angles to the above	·48	·6
Least interval between adjacent margins of nasal apertures	·1	·5
From posterior end of lateral margin of prosopium to its lachrymal process	1·0	1·2
Greatest height of frontal above lachrymal process	·14	·2
Height of jugal at its junction with maxilla	·15	·35
Length of zygoma	2·3	3·1
Length of pterygoid	1·3	1·7
Greatest axial diameter of orbit	1·5	1·7
From dorsal margin of orbit to ventral margin of zygoma taken at right angles to cranial axis	1·7	1·9
From apex of frontal nasal process to distal end of lachrymal	1·9	1·7
From apex of lachymal to apex of sphenotic process	·25	·8
From apex of lachrymal to that of postorbital process	·8	1·2
From apex of postorbital process to that of sphenotic process	·75	·8
From apex of sphenotic process to postaxial margin of the meatus auditorius externus	1·1	1·3
From dorsum of quadrato-jugal articulation to apex of suprameatal process	·55	·7
From dorsum of quadrato-jugal articulation to the greatest prominence beneath it of the ventral articular surface of quadrate	·5	·7

Dimensions of the Skull (continued).

	Lorius.	*Psittacus.*
Length of the cranial articular process of quadrate...	·45	·6
From suprameatal process to apex of paroccipital process	1·0	1·3
From quadrato-jugal articulation to apex of paroccipital process	·9	1·0
From apex of paroccipital process to exoccipital process	·7	·8
Length from middle of cranio-facial articulation of dorsum of skull to vertical plane of apex of prosopium	1·6	2·1
Length from the same point back to the vertical plane of the greatest convexity of occiput	3·5	4·3
Least interorbital breadth	1·9	2·6
Greatest antorbital breadth	2·2	2·9
Greatest postorbital breadth	2·65	3·2
From greatest parietal prominence of one side to that of the other	2·5	2·9
Length of orbit as seen on the skull's dorsal aspect ...	1·5	2·7
Supero-anterior margin of palatine	·9	1·0
Postero-inferior margin of palatine	·55	1·5
Postero-inferior margin of palatine (in straight line)	1·55	2·2
Postero-superior margin of palatine to base of process	·7	1·7
Length of postaxial process	·1	·3
Length of interorbital septum in front of palatine ...	·4	·4
Length of palatine junction with cranium	·6	·8
Length of *basis cranii* from postaxial end of junction of palatine with cranium to eustachian aperture.	·9	·6
Length from preaxial margin of occipital condyle to postaxial mid-junction of pterygoids	1·8	1·8
Length of opening in septum for exit of olfactory nerve	·5	·8
Breadth of that aperture	·4	·3
Length of obscure ridge extending from process external to small orbital foramina to postorbital process	1·1	1·0
From apex of bony beak to middle of lambdoidal ridge (in a straight line), ventral surface of skull being regarded	4·9	6·0
From apex of bony beak to posterior end of palate...	1·3	1·7
From posterior end of middle of posterior margin of palate to front base of occipital condyle	3·2	3·7
Extreme length of palatine from margin of palate to end of palatine postaxial process	1·9	2·65
Breadth between the insides of the two quadrato-pterygoid articulations	1·5	2·0
Breadth between the insides of the two quadrato-jugal articulations	2·1	3·1
Breadth between the posterior apices of the two quadrates	2·1	2·6
Breadth between the posterior apices of the two paroccipital processes	1·6	2·2
Breadth of foramen magnum	·6	·8
Antero-posterior extent of ditto	·55	·7

Dimensions of the Skull (continued).

	Lorius.	*Psittacus.*
Length from posterior margin of palate to preaxial end of junction of palatines	1·1	1·2
From apex of paroccipital process to middle point of lambdoidal ridge	1·5	1·8
From exoccipital process to middle point of lambdoidal ridge	1·1	1·3
From mid-dorsal point of foramen magnum to middle point of lambdoidal ridge	·5	·8
Length from apex of mandible to end of angular process (measured along one ramus)	3·6	4·7
Length of symphysis	1·2	1·2
From apex of mandible to dentary process (measured in a straight line)	·5	1·5
From dentary process to coronoid process	·5	·8
From coronoid process to post-coronoid process	·6	·5
From post-coronoid process to prearticmlar process	·6	1·0
From prearticular process to anterior end of articular surface	·65	·8
From preaxial end of articular process to post-articular process	·5	·9
From post-articular process to angular process	·55	·8
Antero-posterior extent of defect of ossification	none	·5
Dorso-ventral extent of ditto	none	·3
Breadth of fossa for *genioglossi*	·2	·4
Length of articular glenoid groove to quadrate	·6	·8
Breadth of ditto	·22	·3

	Lorius domicella.	*Psittacus erithacus.*
Total length of basi- and urohyals from apex of rostrum to posterior end of urohyal	1·6	1·9
Extreme length of basihyal	1·1	1·1
Its breadth at junction with ceratohyals	·20	·20
Length of urohyal	·3	·70
Breadth of quadrate plate of basihyal at origin of uncinate outgrowths	·3	·48
Its breadth at hinder end	·4	·61
Length of entoglossum	1·0	1·0
Breadth of ditto	·4	·55
Length of basibranchial	2·0	2·10
Breadth of its proximal end	·2	·30
Length of cerato-branchial	·4	·50
Its greatest breadth	·15	·22

Angles of Skull.

	L. flavopalliatus.	*Psittacus.*
Angle of divergence sides of bony beak (seen dorsally)	50°	40°
Angle between sides of cranium from outer end of cranio-facial articulation to most prominent points of postorbital prominences	95	80
Angle to which dorsal margin of orbit approximates when seen from above	120	140
Angle formed by pterygoid with postero-superior margin of palatine	15	35
Angle formed by the line of junction of palatine to cranium with the postero-superior margin of palatine behind that junction	125	150
Angle formed by line of junction of palatine with *basis cranii* behind that junction	170	160
Angle formed by inferior margin of the *basis cranii* with the antero-inferior margin of interorbital septum just in front of its junction with the palatines up to septal process	155	140
Angle of divergence of palatines when skull is viewed from behind	25	23
Angle of divergence of zygomata	35	35
Angle of divergence of pterygoids	85	72
Angle of divergence of palatines when skull is viewed on its ventral surface	...	18
Angle between the antero-superior and the antero-inferior margins of palatine	30	25
Angle between the antero-inferior and the postero-inferior margin of palatine, postaxial process not being taken into account	90	95
Angle of preaxiad divergence of zygoma and pterygoid	25	25
Angle formed by inner and postero-external surfaces of quadrate	72	58
Angle of divergence of mandibular rami	32	32
Angle of oblique line on mandible marking limit of horny beak and ventral margin of the mandible.	120	120

Distinctive Cranial Characters of L. flavopalliatus *from* P. erithacus.

In *L. flavopalliatus*:—

(1) Cranium more flattened.
(2) Prosopium more slender and elongated.
(3) Orbit more enclosed by bone.
(4) Palatines extend less ventrad compared with quadrates.
(5) Occiput less rounded and more inclined preaxiad above lambdoidal ridge.

(6) Paroccipital processes more sharply inclined backwards.
(7) More distinct from relatively smaller quadrates.
(8) Orbits more deeply incised dorsally.
(9) Prosopium in front of nares at first less sloped, afterwards more sharply so.
(10) Nostrils look more dorsad and are larger.
(11) No excavation in front of each.
(12) Internasal space narrower.
(13) Hindermost part of tomial margin concave.
(14) Margin above suprajugular process usually straight.
(15) Lachrymal process of prosopium minute and almost on a line with dorsum of cranium.
(16) Prosopial angle 50°.
(17) Bony palate more concave.
(18) Its free median hinder margin as long as the two palatal articulations conjoined.
(19) Lateral palatal processes ventrally grooved.
(20) Preaxial end of zygoma less dorso-ventrally expanded.
(21) Ventral margin of palatines more concave.
(22) Posterio-inferior angle more prominent.
(23) Posterior palatine process very much shorter.
(24) Lachrymal nearly reaches sphenotic.
(25) An ectosphenotic process.
(26) Meatus auditorius externus limited in front by a delicate lamella behind quadrate column.
(27) Posterior margin of meatus auditorius externus concave at upper two-thirds, slightly convex below this.
(28) Posterior part of body of quadrate smaller.
(29) Antero-posterior groove outside lachrymal very marked.
(30) Mesiad inflated part of palatine more considerable.
(31) Precondyloid fossa deep.
(32) Posterior margin of basipterygoid shield like a wide letter **M**.
(33) Infero-external surface of paroccipital process strongly concave transversely.
(34) Quadrate column longer and more slender.
(35) Geniohyoid fossa more marked and relatively nearer to the postaxial margin of symphysis.
(36) No ramal defect of ossification.
(37) Symphysis relatively much longer.
(38) Mandible less concave from apex to dentary process.
(39) Rami and symphysis form together a pointed arch.
(40) Ramus narrows more gradually backwards.
(41) Margin between prearticular and coronoid processes shorter and steeper.
(42) Margin between coronoid and postcoronoid processes longer and less concave.
(43) No postarticular process.

Eos rubra appears to agree with *Lorius flavopalliatus* in all the above points except—

1. Apex of prosopium not so much bent down though more so than in *P. erithacus*.
2. Prosopium longer and slenderer because its relative dorso-ventral extent in front of nares is less.
3. Anterior palatine foramen much larger.
4. Mid-junction of palatines antero-posteriorly shorter.
5. Posterior margin of palatines less concave.
6. Postero-ventral angle more produced and much sharper than in either *L. flavopalliatus* or *P. erithacus*.
7. No marked prequadrate process of sphenotic process.
8. No concavity at hinder end of tomial margin.
9. Middle of postaxial margin of bony palate more prominent—almost a process.
10. Cranium, seen above, longer and narrower.
11. Distinct antero-posteriorly extending transverse concavity in parietal region.
12. Prosopium, seen above, much longer.
13. Interorbital extent of cranium narrower absolutely and relatively.
14. Paroccipital processes rather less projecting postaxiad and their apices mesiad.
15. Median ridge of ventral aspect of prosopium behind bony palate much more marked.
16. Postaxial margin of prosopium between zygoma and lachrymal process rather more extensive and more concave.
17. Median supraoccipital prominence less marked.
18. Bony symphysis of mandible relatively as well as absolutely shorter.
19. Projection mesiad of inner articular process of mandible rather less.
20. Arch of symphysis (mandible being viewed from beneath) more acute—much as in *P. erithacus*.
21. Apices of angular processes rather more inflected mesiad.
22. Tomial margin between apex of symphysis and dental process slightly more concave.

May 21, 1895.

Lt.-Col. H. H. Godwin-Austen, F.R.S., Vice-President, in the Chair.

Mr. Sclater made some remarks on the Zoological Institutions which he had recently visited in Cairo. These were the new Zoological Garden at Gizeh, the Zoological Collection in the Medical School at Cairo, and the Ostrich Farm at Matariyeh.

Part of the former Palace-Garden at Gizeh had recently been appropriated by the Egyptian Government as a Zoological Garden, of which a young Englishman, Mr. Jennings Bramley, had been appointed Manager. The Institution was at present quite in its infancy, but had the great advantage of a beautiful garden of 20 acres, well stocked with fine trees and shrubs, and furnished with an abundant water-supply. The small collection already made consisted principally of well-known Egyptian animals, with a certain number of Oriental species, obtained from ships passing through the Suez Canal.

Amongst the Egyptian animals, besides the ordinary *Gazella dorcas*, of which there were many specimens, Mr. Sclater had examined individuals of both sexes of another Gazelle, said to have been obtained in the Libyan Desert. This belonged to the group with long straight horns, allied to *G. cuvieri* and *G. leptoceros* (*cf.* Brooke, P. Z. S. 1873, p. 543). Mr. Sclater was endeavouring to obtain more information respecting it, but there could be no doubt of the existence of a second species of Gazelle in Egypt.

Amongst the birds in the gardens, Mr. Sclater had noticed two fine specimens of Rüppell's Griffon (*Gyps rueppelli*), said also to have been obtained from the Western Desert. This species was not recognized in Shelley's 'Birds of Egypt;' and it was rather surprising to meet with it so far north.

The only zoological collection in Cairo was that of the Government School of Medicine, under the care of Dr. Innes. It was at present in an undeveloped condition, but contained a series of Egyptian animals along with others from various parts of the world, intended originally for educational purposes. It was hoped with Dr. Anderson's promised assistance, and aid from other quarters, to make considerable additions to the Egyptian series. There could be no doubt that the capital of Egypt ought to contain a good exhibition of the native animals.

The Ostrich Farm at Matariyeh, near the Khedive's palace at Kubbeh, was, in Mr. Sclater's opinion, one of the most interesting sights in Cairo. It was said to have been commenced with some twenty birds from two sources about fifteen years ago, and now contained about 1400 Ostriches of different ages. The birds were placed in small compartments enclosed by mud walls ten feet high, and arranged according to age, both sexes being kept together. After four or five years, when fully adult and showing signs of

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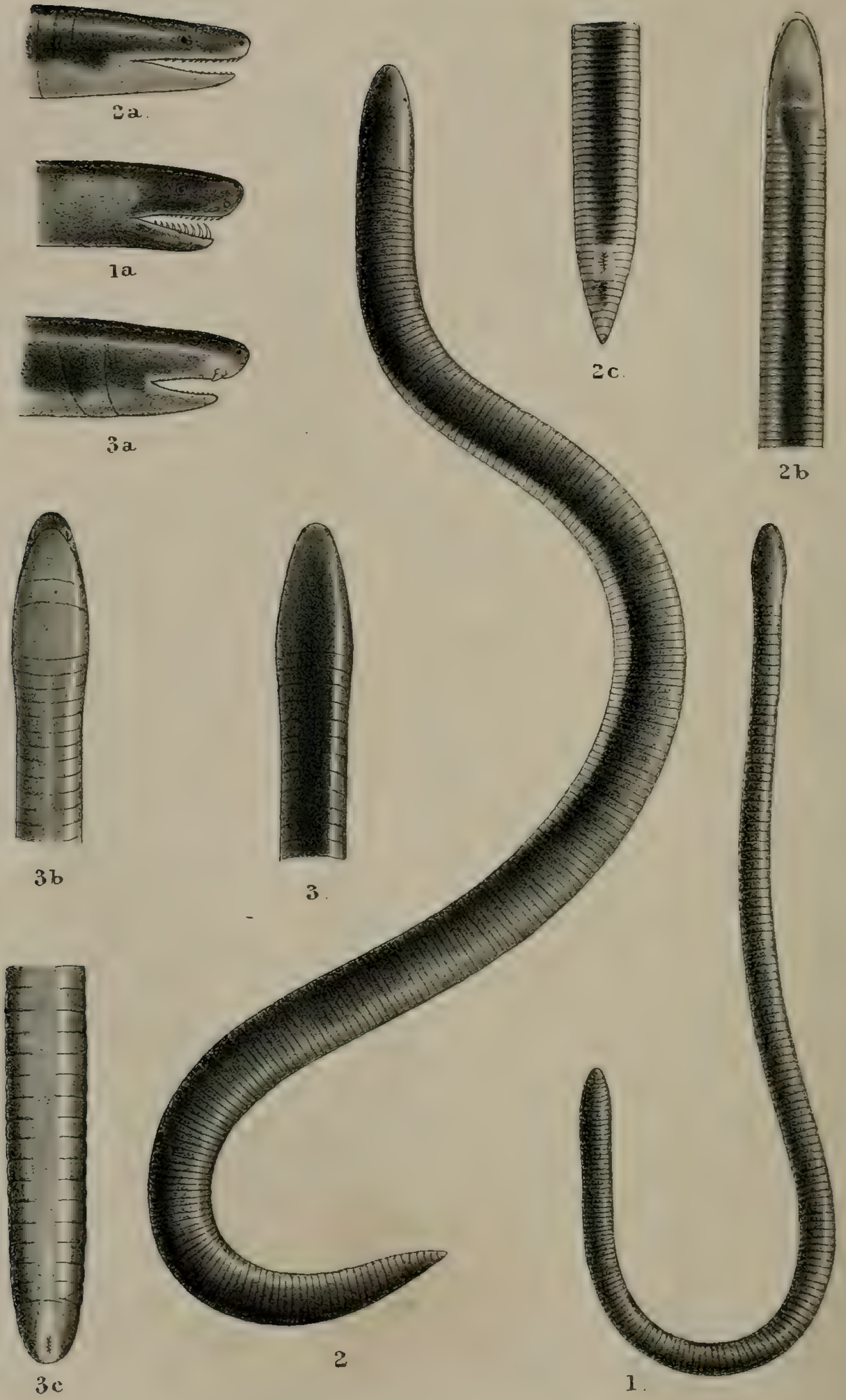

J. Green & R.E.M. del. et lith.

Mintern Bros. imp.

1. CÆCILIA BUCKLEYI. 2. RHINATREMA BICOLOR.
3. SCOLECOMORPHUS KIRKII.

BRITISH MUSEUM
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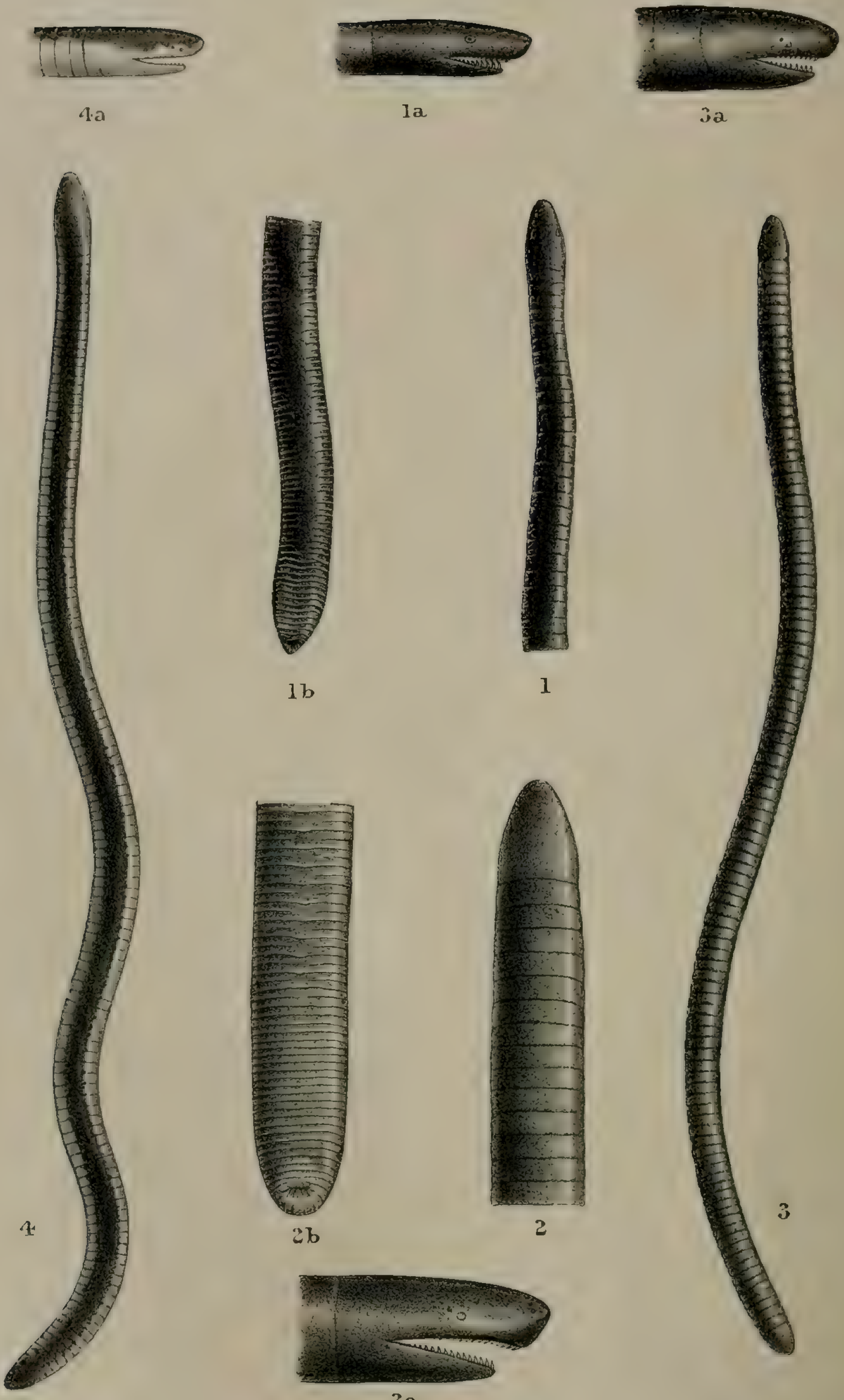
NATURAL HISTORY.

P. Z. S. 1895. Pl. XXIV.



J Green & R.E.M. del et lith.
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1. GEOTRYPETES PETERSII. 2. CRYPTOPSOPHIS MULTIPLICATUS.
3. SIPHONOPS HARDYI 4. BDELLOPHIS VITTATUS.

wishing to breed, a pair was selected and put together in a separate enclosure. Here the eggs were laid, and the birds, as Mr. Sclater was assured, took turns in sitting; but many of the eggs were hatched in incubators. In one compartment were contained 11 examples (6 males and 5 females) of the very distinct Somali Ostrich, *Struthio molybdophanes*. The remainder were all of the typical northern form, *S. camelus*, with red naked skin; and amongst them were many very fine birds, quite as large as the well-known specimen lately in the Zoological Society's Gardens, from Western Africa, deposited by the Queen.

Mr. Howard Saunders, F.Z.S., exhibited, on behalf of Mr. R. M. Barrington, a hybrid Duck shot in March last on the Moy Estuary, in the West of Ireland. It was evidently a cross between the Wigeon (*Mareca penelope*) and some other species; the other parent being supposed to have been the Gadwall (*Chaulelasmus streperus*) by some authorities, while others inclined to the Pintail (*Dafila acuta*), and others again to the Teal (*Querquedula crecca*).

Mr. Tegetmeier exhibited and made remarks on a specimen of a Rook (*Corvus frugilegus*), one of a number produced in one Rookery, in which every feather of the entire plumage was tipped or spangled with white.

The following papers were read:—

1. A Synopsis of the Genera and Species of Apodal Batrachians, with Description of a new Genus and Species (*Bdellophis vittatus*). By G. A. Boulenger, F.R.S.

(Plates XXIII. & XXIV.)

[Received April 19, 1895.]

Whilst describing a new Cæcilian it has occurred to me that a revised list of the 42 species of this order now known would prove useful to the student of these interesting but still very imperfectly known Batrachians. Since the publication of the last revision (Cat. Batr. Grad. &c. 1882), in which 11 genera and 32 species were defined, many new species have been described and numerous additions and corrections have been made to the synonymy by Cope, Boettger, Vaillant, Stejneger, and myself. These alterations have all been worked into the list now offered for publication to the Society. In order to facilitate identifications, synopses of the genera and species have been inserted. The prefix of an asterisk indicates that the species is represented in the British Museum.

I still think it desirable to retain the *Apoda* as an order distinct from the *Caudata*, in spite of the views expressed by Prof. Cope and the Drs. Sarasin. If the absence of limbs and the reduction of the tail were the only characteristic of the group, I should of course not hesitate to unite the Cæcilians with the Urodeles; but, to say nothing of the scales, the Cæcilian skull presents features which are not shared by any of the tailed Batrachians, and the order can be defined by the cranial characters alone. The resemblance of the larval *Ichthyophis* to *Amphiuma* is, after all, superficial; and although, as I believe, the *Apoda* and *Caudata* may have evolved from a common stock, *Amphiuma* is certainly not the connecting form between the two, as Prof. Cope would have it, for we cannot well assume the scales, lost in the Urodeles, to have reappeared in the Cæcilians.

I wish, furthermore, to justify the use of the name *Apoda* for the order often designated as *Pseudophidia*, *Batrachophidia*, *Gymnophiona*, or *Peromela*. Unless obviously misleading, which is not the case in the present instance, the first-proposed name should supersede all others for higher groups as well as for genera and species, and "*Apoda*" has the benefit of the law of priority. In the first subdivision of the Batrachians into two families by Duméril in 1806 (Zool. Anal. pp. 90–94) these groups are termed "*Anoures*" and "*Urodèles*" in French, *Ecaudati* and *Caudati* in Latin. When Duméril's pupil, Oppell, in 1811 (Ordn. Rept. p. 72), added the Cæcilians, he named the three groups *Apoda*, *Ecaudata*, and *Caudata*. The Latin form being the only one entitled to recognition in zoological nomenclature, it follows that the last mentioned names should be adopted for the three orders into which Batrachians are divided.

Order APODA.

No limbs. Tail vestigial or absent. Frontal bones distinct from parietals; palatines fused with maxillaries. Male with an intromittent copulatory organ.

Fam. CÆCILIIDÆ.

Synopsis of the Genera.

I. Cycloid scales imbedded in the skin.
  A. Eyes distinct or concealed under the skin.
    1. Two series of teeth in the lower jaw.
      a. Squamosal and parietal bones in contact.

Tentacle conical, below and in front of the eye, usually much nearer the latter than the nostril; circular folds angulate on the belly .... 1. ICHTHYOPHIS.
Tentacle globular, surrounded by a groove, in front of the eye .... 2. DERMOPHIS.
Tentacle valvular, tentacular groove horseshoe-shaped, posterior to the nostril .... 3. HYPOGEOPHIS.
Tentacle valvular, tentacular groove horseshoe-shaped, below the nostril .... 4. CÆCILIA.

b. Squamosals separated from parietals.

Tentacle valvular, close to the eye .... 5. RHINATREMA.
Tentacle valvular, below and behind the nostril .... 6. GEOTRYPETES.
Tentacle conical, below the nostril .... 7. URÆOTYPHLUS.

2. A single series of teeth in the lower jaw; tentacle globular, in front of the eye .... 8. CRYPTOPSOPHIS.

B. Eyes below the cranial bones; squamosals in contact with parietals; tentacle globular.

Tentacle below and a little behind the nostril .... 9. HERPELE.
Tentacle nearer the commissure of the jaws than the nostril .... 10. GYMNOPIS.

II. No scales.

A. Eyes distinct or concealed under the skin.

1. Two series of teeth in the lower jaw.

Parietals and squamosals in contact .... 11. TYPHLONECTES.
Parietals separated from squamosals .... 12. CHTHONERPETON.

2. A single series of teeth in the lower jaw.

Parietals and squamosals in contact .... 13. SIPHONOPS.
Parietals separated from squamosals .... 14. BDELLOPHIS.

B. Eyes below the cranial bones.

Two series of teeth in the lower jaw; parietals and squamosals in contact .... 15. GEGENOPHIS.
A single series of teeth in the lower jaw; parietals separated from squamosals .... 16. SCOLECOMORPHUS

1. ICHTHYOPHIS.

Ichthyophis, Fitzing. N. Class. Rept. p. 36 (1826); Peters, Mon. Berl. Ac. 1879, p. 931; Bouleng. Cat. p. 89 (1882).

Epicrium, Wagl. Isis, 1828, p. 743, and Syst. Amph. p. 198 (1830); Dum. & Bibr. viii. p. 285 (1841); A. Dum. Mém. Soc. Cherb. ix. 1863, p. 319.

Synopsis of the Species.

Snout as long as the distance between the eyes; a yellow lateral band .... 1. *glutinosus.*
Snout shorter than the distance between the eyes; no lateral band .... 2. *monochrous.*

*1. ICHTHYOPHIS GLUTINOSUS.

Cæcilia glutinosa, Linn. Mus. Ad. Frid. p. 19, pl. iv. fig. 1 (1754), and S. N. i. p. 393 (1766); Daud. Rept. vii. p. 418 (1803); Peters, Mon. Berl. Ac. 1864, p. 303.

Cæcilia viscosa, Latr. Rept. iv. p. 238 (1802)

Ichthyophis hasseltii, Fitzing. N. Class. p. 63 (1826).

Cæcilia hypocyanea, Hasselt, Isis, 1827, p. 565; Müll. Zeitschr. f. Physiol. iv. 1831, p. 195, and Arch. Anat. Phys. 1835, p. 391, pl. viii. figs. 12–14; Schleg. Abbild. p. 119, pl. xxxix. fig. 1 (1844).

Epicrium hasseltii, Wagl. Isis, 1828, p. 743.

Epicrium glutinosum, Dum. & Bibr. viii. p. 286 (1841); A. Dum. Mém. Soc. Cherb. ix. 1863, p. 319; Günth. Rept. Brit. Ind. p. 441 (1864).

Ichthyophis glutinosus, Cantor, Cat. Mal. Rept. p. 138 (1847); Gray, Cat. p. 60 (1850); Peters, Mon. Berl. Ac. 1879, p. 931, pl. —. figs. 1 & 3; Bouleng. Cat. p. 89, pl. iv. fig. 2 (1882); Sarasin, Nat. Forsch. Ceylon, ii. (1887–1890); Bouleng. Ann. Mus. Genova, (2) v. 1887, p. 423, pl. iv. fig. 4, and Faun. Ind., Rept. p. 515 (1890).

Ichthyophis beddomii, Peters, Mon. Berl. Ac. 1879, p. 932, pl. —. fig. 4.

Southern India; Ceylon; Eastern Himalayas; Assam; Burma; Indo-China; Malay Peninsula; Sumatra; Borneo; Java.

*2. ICHTHYOPHIS MONOCHROUS.

Ichthyophis glutinosus, var., Cantor, Cat. Mal. Rept. p. 137 (1847).

Epicrium monochroum, Bleek. Nat. Tijdschr. Nederl. Ind. xvi. 1858, p. 188; Günth. Rept. Brit. Ind. p. 443 (1864).

Ichthyophis monochrous, Peters, Mon. Berl. Ac. 1879, p. 932; Bouleng. Cat. p. 91, pl. iv. fig. 1 (1882), and Faun. Ind., Rept. p. 517 (1890).

Western Ghats of India, from Bombay to Travancore[1]; Sikkim; Singapore; Sumatra; Borneo; Java.

2. DERMOPHIS.

Siphonops, part., Dum. & Bibr. viii. p. 281 (1841); A. Dum. Mém. Soc. Cherb. ix. 1863, p. 317.

Dermophis, Peters, Mon. Berl. Ac. 1879, p. 937; Bouleng. Cat. p. 97 (1882).

Synopsis of the Species.

I. Diameter of body 46 times in total length; 170 folds; tentacle in front of, and scarcely below, the eye .... 1. *albiceps.*

II. Diameter of body 20 to 30 times in total length; 125–170 folds.

Snout rounded, as long as the distance between the eyes......... 2. *mexicanus.*

Snout rounded, a little longer than the distance between the eyes .... 3. *gregorii.*

Snout acuminate; the distance between tentacle and nostril four to five times that between tentacle and eye .... 4. *thomensis.*

III. Diameter of body 19 times in total length; 95 folds ... 5. *crassus.*

*1. DERMOPHIS ALBICEPS.

Dermophis albiceps, Bouleng. Cat. p. 98, pl. viii. fig. 1 (1882).

Ecuador.

*2. DERMOPHIS MEXICANUS.

Siphonops mexicanus, Dum. & Bibr. viii. p. 284 (1841); Gray, Cat. p. 59 (1850); A. Dum. Mém. Soc. Cherb. ix. 1863, p. 23, pl. i. fig. 10; Brocchi, Miss. Sc. Mex., Batr. p. 120, pl. xxi. fig. 2 (1882).

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[1] A fine specimen from Maduvangaud, Travancore, presented by Mr. H. S. Ferguson, measures 500 millim.

Dermophis mexicanus, Peters, Mon. Berl. Ac. 1879, p. 937, pl. —. fig. 6; Bouleng. Cat. p. 98, pl. viii. fig. 2 (1882).

Mexico and Central America.

*3. Dermophis gregorii.

Dermophis gregorii, Bouleng. P. Z. S. 1894, p. 646, pl. xl. fig. 4 (1895).

Ngatana, East Africa.

*4. Dermophis thomensis.

Siphonops thomensis, Bocage, Jorn. Sc. Lisb. iv. 1873, p. 224.

Siphonops brevirostris, Peters, Mon. Berl. Ac. 1874, p. 617, pl. i. fig. 2.

Dermophis brevirostris, Peters, Mon. Berl. Ac. 1879, p. 937.

Dermophis thomensis, Peters, *l. c.* p. 938, and 1880, p. 223; Bouleng. Cat. p. 98 (1882); Greef, Sitzb. Ges. Marburg, 1884, p. 15; Bedriaga, Amph. & Rept. I. Guin. p. 13 (1892).

S. Thomé, Gulf of Guinea.

5. Dermophis crassus.

Dermophis crassus, Cope, Proc. Am. Philos. Soc. xxii. 1885, p. 184.

Bolivia; Eastern Peru.

The systematic position of the following species, provisionally referred to *Dermophis* by Cope, is very doubtful:—

Siphonops syntremus, Cope, Proc. Ac. Philad. 1866, p. 129.

Typhlonectes? syntremus, Peters, Mon. Berl. Ac. 1879, p. 941.

Dermophis syntremus, Cope, Proc. Am. Philos. Soc. xxii. 1885, p. 171.

Belize.

3. Hypogeophis.

Cæcilia, part., Dum. & Bibr. viii. p. 274 (1841); A. Dum. Mém. Soc. Cherb. ix. 1863, p. 311.

Hypogeophis, Peters, Mon. Berl. Ac. 1879, p. 936; Bouleng. Cat. p. 96 (1882).

Synopsis of the Species.

Tentacle much nearer the nostril than the eye; 100 folds ……	1. *guentheri.*
Tentacle much nearer the nostril than the eye; 105–130 folds…	2. *rostratus.*
Tentacle not or but little nearer the nostril than the eye; 175 folds ……	3. *alternans.*

*1. Hypogeophis guentheri.

Hypogeophis guentheri, Bouleng. Cat. p. 96, pl. vii. fig. 1 (1882).

Zanzibar.

*2. HYPOGEOPHIS ROSTRATUS.

Cæcilia rostrata, Cuv. R. A. 2nd ed. ii. p. 100 (1829); Dum. & Bibr. viii. p. 279 (1841); Peters, Mon. Berl. Ac. 1877, p. 456.

Hypogeophis rostratus, Peters, Mon. Berl. Ac. 1879, p. 936, and Sitzb. Ges. naturf. Fr. 1880, p. 53; Bouleng. Cat. p. 96, pl. vii. fig. 2 (1882); Stejneg. Proc. U. S. Nat. Mus. xvi. 1894, p. 738.

Seychelles.

*3. HYPOGEOPHIS ALTERNANS.

Hypogeophis alternans, Stejneg. Proc. U. S. Nat. Mus. xvi. 1894, p. 739.

Seychelles.

4. CÆCILIA.

Cæcilia, part., Linn. S. N. i. p. 229 (1766).

Cæcilia, Wagl. Syst. Amph. p. 198 (1830); Dum. & Bibr. viii. p. 274 (1841); A. Dum. Mém. Soc. Cherb. ix. 1863, p. 311; Peters, Mon. Berl. Ac. 1879, p. 934; Bouleng. Cat. p. 93 (1882).

Synopsis of the Species.

I. Total length not 60 times greatest diameter of body.	
135–150 circular folds, last 40 to 50 not interrupted on the dorsal line	1. *tentaculata.*
115–140 circular folds, last 16 to 20 not interrupted on the dorsal line	2. *isthmica.*
175 circular folds, all complete	3. *buckleyi.*
II. Total length more than 60 times greatest diameter of body.	
207–209 circular folds, nearly all complete	4. *polyzona.*
160–170 circular folds, interrupted on the dorsal and ventral lines	5. *pachynema.*
210–255 circular folds, interrupted on the dorsal and ventral lines	6. *gracilis.*

*1. CÆCILIA TENTACULATA.

Cæcilia, Linn. Amœn. Acad. i. p. 489, pl. xvii. fig. 1 (1754).

Cæcilia tentaculata, part., Linn. Mus. Ad. Frid. p. 19 (1754), and S. N. i. p. 393 (1766).

Cæcilia tentaculata, Shaw, Zool. iii. p. 599, pl. cxxxvi. (1802); Peters, Mon. Berl. Ac. 1879, p. 934; Bouleng. Cat. p. 93 (1882).

Cæcilia albiventris, Daud. Rept. vii. p. 423, pl. xcii. fig. 1 (1803); Dum. & Bibr. viii. p. 277 (1841).

Guianas.

*2. CÆCILIA ISTHMICA.

Cæcilia rostrata (non Cuv.), Günth. P. Z. S. 1859, p. 417.

Cæcilia isthmica, Cope, Proc. Am. Philos. Soc. xvii. 1877, p. 91; Bouleng. Cat. p. 94, pl. vi. fig. 1 (1882).

Cæcilia guentheri, Peters, Mon. Berl. Ac. 1879, p. 936.

Cæcilia pachynema (non Gthr.), Bouleng. Bull. Soc. Zool. France, 1880, p. 48.

Isthmus of Darien; Ecuador.

*3. CÆCILIA BUCKLEYI. (Plate XXIII. fig. 1.)

Cæcilia buckleyi, Bouleng. Ann. & Mag. N. H. (5) xiii. 1884, p. 398.

Intac, Ecuador.

*4. CÆCILIA POLYZONA.

Cæcilia polyzona, Fischer, Mon. Berl. Ac. 1879, p. 937, and Arch. f. Nat. 1880, p. 215, pl. viii. figs. 1–4; Bouleng. Cat. p. 94 (1882).

Colombia.

*5. CÆCILIA PACHYNEMA.

Cæcilia pachynema, Günth. P. Z. S. 1859, p. 417; Peters, Mon. Berl. Ac. 1879, p. 935; Bouleng. Cat. p. 95, pl. vi. fig. 2 (1882).

W. Ecuador.

*6. CÆCILIA GRACILIS.

Cæcilia tentaculata, part., Linn. Mus. Ad. Frid. p. 19, pl. v. fig. 2 (1754), and S. N. i. p. 393 (1766).

Cæcilia gracilis, Shaw, Zool. iii. p. 597 (1802); Gray, Cat. p. 57 (1850); Günth. P. Z. S. 1859, p. 417; Peters, Mon. Berl. Ac. 1879, p. 937; Bouleng. Cat. p. 95 (1882).

Cæcilia lumbricoidea, Daud. Rept. vii. p. 420, pl. xcii. fig. 2 (1803); Dum. & Bibr. viii. p. 275 (1841); A. Dum. Mém. Soc. Cherb. ix. 1863, p. 313.

Guianas, N. Brazil.

5. RHINATREMA.

Rhinatrema, Dum. & Bibr. viii. p. 288 (1841); A. Dum. Mém. Soc. Cherb. ix. 1863, p. 320; Vaill. C. R. Ac. Sc. cxx. 1895, p. 460.

Epicrionops, Bouleng. Ann. & Mag. N. H. (5) vi. 1883, p. 202.

Synopsis of the Species.

340 circular folds	1. *bivittatum.*
245 circular folds	2. *bicolor.*

1. RHINATREMA BIVITTATUM.

Cæcilia bivittata, Cuv. R. A. 2nd ed. ii. p. 100 (1829); Guér. Icon. R. A., Rept. pl. xxv. fig. 2 (18—?).

Rhinatrema bivittatum, Dum. & Bibr. viii. p. 288, pl. lxxxv. fig. 4 (1841); Peters, Mon. Berl. Ac. 1879, p. 942, pl. —. fig. 2; Vaill. C. R. Ac. Sc. cxx. 1895, p. 461.

Cayenne.

*2. RHINATREMA BICOLOR. (Plate XXIII. fig. 2.)

Epicrionops bicolor, Bouleng. Ann. & Mag. N. H. (5) xi. 1883, p. 202.

Rhinatrema bicolor, Vaill. C. R. Ac. Sc. cxx. 1895, p. 461.

Intac, Ecuador.

Prof. Vaillant has recently pointed out that the late Prof. Peters was mistaken in identifying the type specimen of *C. bivittata*, which he had an opportunity of examining, with *Ichthyophis glutinosus*, and that the genus *Rhinatrema* is in every respect identical with *Epicrionops*, established by me in 1883, at a time when I had no reason to question the correctness of Peters's identification. It is now to me even a matter of doubt whether the two species mentioned above are really distinct, considering the amount of variation in the number of folds in *Ichthyophis*.

6. GEOTRYPETES.

Geotrypetes, Peters, Sitzb. Ges. naturf. Fr. Berl. 1880, p. 55; Bouleng. Ann. & Mag. N. H. (6) xv. 1895, p. 329.

1*. GEOTRYPETES PETERSII. (Plate XXIV. fig. 1.)

Hypogeophis seraphini (non A. Dum.), Peters, Mon. Berl. Ac. 1879, p. 937.

Geotrypetes seraphini, Peters, Sitzb. Ges. naturf. Fr. 1880, p. 55.

Geotrypetes petersii, Bouleng. Ann. & Mag. N. H. (6) xv. 1895, p. 329.

West Africa (Lagos, Cameroon).

7. URÆOTYPHLUS.

Cæcilia, part., Dum. & Bibr. viii. p. 274 (1841); A. Dum. Mém. Soc. Cherb. ix. 1863, p. 311.

Uræotyphlus, Peters, Mon. Berl. Ac. 1879, p. 933; Bouleng. Cat. p. 91 (1882).

Synopsis of the Species.

Snout moderately prominent, as long as the distance between the eyes; 120–130 folds	1. *seraphini.*
Snout moderately prominent, as long as the distance between the eyes; 200 folds	2. *oxyurus.*
Snout very prominent, longer than the distance between the eyes; 240–260 folds	3. *malabaricus.*

*1. URÆOTYPHLUS SERAPHINI.

Cæcilia seraphini, A. Dum. Arch. Mus. x. 1859, p. 222, and Mém. Soc. Cherb. ix. 1863, p. 314.

Uræotyphlus africanus, Bouleng. Cat. p. 92, pl. v. fig. 1 (1882).

Uræotyphlus seraphini, Bouleng. Ann. & Mag. N. H. (6) xv. 1895, p. 328.

Gaboon.

*2. URÆOTYPHLUS OXYURUS.

Cæcilia oxyura, Dum. & Bibr. viii. p. 280 (1841); A. Dum. Mém. Soc. Cherb. ix. 1863, p. 22, pl. i. fig. 8; Günth. Rept. Brit. Ind. p. 443 (1864).

Uræotyphlus oxyurus, Peters, Mon. Berl. Ac. 1879, p. 933, and

Sitzb. Ges. naturf. Fr. 1881, p. 90; Bouleng. Cat. p. 92, pl. v. fig. 2 (1882), and Faun. Ind., Rept. p. 517 (1890).

Malabar.

*3. URÆOTYPHLUS MALABARICUS.

Cæcilia malabarica, Beddome, Madr. Monthly Journ. Med. Sc. 1870, p. 176.

Uræotyphlus malabaricus, Peters, Mon. Berl. Ac. 1879, p. 933; Bouleng. Cat. p. 92, pl. v. fig. 3 (1882), and Faun. Ind., Rept. p. 518 (1890).

Malabar.

8. CRYPTOPSOPHIS.

Cryptopsophis, Bouleng. Ann. & Mag. N. H. (5) xii. 1883, p. 166.

*1. CRYPTOPSOPHIS MULTIPLICATUS. (Plate XXIV. fig. 2.)

Cryptopsophis multiplicatus, Bouleng. *l. c.*

Seychelles.

9. HERPELE.

Cæcilia, part., Gray, Cat. p. 59 (1850); A. Dum. Mém. Soc. Cherb. ix. 1863, p. 311.

Herpele, Peters, Mon. Berl. Ac. 1879, p. 939; Bouleng. Cat. p. 100 (1882).

Synopsis of the Species.

130–150 circular folds	1. *squalostoma.*
200–206 circular folds	2. *ochrocephala.*

*1. HERPELE SQUALOSTOMA.

Cæcilia squalostoma, Stutchbury, Trans. Linn. Soc. xvii, 1850, p. 362; Gray, Cat. p. 59 (1850); A. Dum. Arch. Mus. x. 1859, p. 222, and Mém. Soc. Cherb. ix. 1863, p. 314.

Herpele squalostoma, Peters, Mon. Berl. Ac. 1879, p. 939, pl. —. fig. 8; Bouleng. Cat. p. 101, pl. ix. fig. 1 (1882).

Gaboon.

*2. HERPELE OCHROCEPHALA.

Cæcilia ochrocephala, Cope, Proc. Ac. Philad. 1866, p. 132; Bouleng. Cat. p. 94 (1882); Brocchi, Miss. Sc. Mex., Batr. p. 119, pl. xxi. fig. 1 (1882).

Herpele ochrocephala, Cope, Proc. Am. Philos. Soc. xxii. 1885, p. 171.

Panama.

10. GYMNOPIS.

Rhinatrema, part., A. Dum. Mém. Soc. Cherb. ix. 1863, p. 320.

Gymnopis, Peters, Mon. Berl. Ac. 1874, p. 216, and 1879, p. 938; Bouleng. Cat. p. 99 (1882).

Synopsis of the Species.

Diameter of body 27 or 28 times in total length; 228–250 folds.	1. *multiplicata.*
Diameter of body 23 times in total length; 129 folds	2. *proxima.*
Diameter of body 37 or 38 times in total length; 180–190 folds.	3. *unicolor.*
Diameter of body 47 to 53 times in total length; 166–200 folds.	4. *oligozona.*

1. GYMNOPIS MULTIPLICATA.

Gymnopis multiplicata, Peters, Mon. Berl. Ac. 1874, p. 616, pl. i. fig. 1, and 1879, p. 939, pl. —. fig. 7; Bouleng. Cat. p. 100 (1882).

Siphonops simus, Cope, Proc. Am. Philos. Soc. xvii. 1877, p. 91.

Dermophis ? simus, Peters, Mon. Berl. Ac. 1879, p. 938; Bouleng. *l. c.* p. 99.

Gymnopis sima, Cope, Proc. Am. Philos. Soc. xxii. 1885, p. 171.

Costa Rica; Veragua; Antioquia.

2. GYMNOPIS PROXIMA.

Siphonops proximus, Cope, Proc. Am. Philos. Soc. xvii. 1877, p. 90.

Dermophis ? proximus, Peters, Mon. Berl. Ac. 1879, p. 938; Bouleng. Cat. p. 99 (1882).

Gymnopis proxima, Cope, Proc. Am. Philos. Soc. xxii. 1885, p. 171.

Costa Rica.

*3. GYMNOPIS UNICOLOR.

Rhinatrema unicolor, A. Dum. Mém. Soc. Cherb. ix. 1863, p. 321, pl. i. figs. 6, 7.

Gymnopis unicolor, Peters, Mon. Berl. Ac. 1879, p. 939; Bouleng. Cat. p. 100 (1882).

Cayenne.

*4. GYMNOPIS OLIGOZONA.

Siphonops oligozonus, Cope, Proc. Am. Philos. Soc. xvii. 1877, p. 91.

Gymnopis ? oligozona, Peters, Mon. Berl. Ac. 1879, p. 939; Bouleng. Cat. p. 100 (1882).

Gymnopis oligozona, Cope, Proc. Am. Philos. Soc. xxii. 1885, p. 171.

Guatemala[1].

11. TYPHLONECTES.

Cæcilia, part., Dum. & Bibr. viii. p. 274 (1841); A. Dum. Mém. Soc. Cherb. ix. 1863, p. 311.

Typhlonectes, Peters, Mon. Berl. Ac. 1879, p. 940; Bouleng. Cat. p. 102 (1882).

Synopsis of the Species.

135–167 circular folds, interrupted on the back	1. *compressicauda.*
99 circular folds, all complete	2. *kaupii.*
Circular folds indistinct	3. *natans.*

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[1] The origin of the type specimen is unknown. A specimen from Guatemala, received from the Basle Museum, is in the British Museum.

*1. TYPHLONECTES COMPRESSICAUDA.

Cæcilia compressicauda, Dum. & Bibr. viii. p. 278 (1841); Peters, Mon. Berl. Ac. 1874, p. 45, and 1875, p. 483, pl. —.

Typhlonectes compressicauda, Peters, Mon. Berl. Ac. 1879, p. 941, pl. —; Bouleng. Cat. p. 102 (1882).

Guianas; Venezuela; N. Brazil[1].

2. TYPHLONECTES KAUPII.

Siphonops kaupii, Berthold, Götting. Nachr. 1859, p. 181, and 1867, p. 361.

Cæcilia dorsalis, Peters, Mon. Berl. Ac. 1877, p. 459, pl. —.

Typhlonectes dorsalis, Peters, Mon. Berl. Ac. 1879, p. 941; Bouleng. Cat. p. 103 (1882).

Typhlonectes kaupii, Bouleng. Ann. & Mag. N. H. (6) viii. 1891, p. 457.

Venezuela.

*3. TYPHLONECTES NATANS.

Cæcilia natans, Fischer, Mon. Berl. Ac. 1879, p. 941, and Arch. f. Nat. 1880, p. 217, pl. viii. figs. 5–7.

Typhlonectes natans, Peters, Mon. Berl. Ac. 1879, p. 941; Bouleng. Cat. p. 103, pl. ix. fig. 3 (1882).

Cacera, Colombia.

12. CHTHONERPETON.

Chthonerpeton, Peters, Mon. Berl. Ac. 1879, p. 940; Bouleng. Cat. p. 104 (1882).

Synopsis of the Species.

Eyes distinct; diameter of body 26 times in total length; 78–100 circular folds.......... 1. *indistinctum*.
Eyes indistinct; diameter of body 39 times in total length; 145 circular folds .... 2. *petersii*.

*1. CHTHONERPETON INDISTINCTUM.

Siphonops indistinctus, Reinh. & Lütk. Vid. Meddel. 1861, p. 203.

Chthonerpeton indistinctum, Peters, Mon. Berl. Ac. 1879, p. 940; Bouleng. Cat. p. 104 (1882).

S. Brazil; Buenos Ayres.

*2. CHTHONERPETON PETERSII.

Chthonerpeton petersii, Bouleng. Cat. p. 104, pl. ix. fig. 2 (1882).

Upper Amazon.

13. SIPHONOPS.

Siphonops, Wagl. Isis, 1828, p. 740, and Syst. Amph. p. 198 (1830); Peters, Mon. Berl. Ac. 1879, p. 940; Bouleng. Cat. p. 101 (1882).

Siphonops, part., Dum. & Bibr. viii. p. 282 (1841); A. Dum. Mém. Soc. Cherb. ix. 1863, p. 317.

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[1] A fine specimen from Manaos is in the British Museum.

Synopsis of the Species.

Tentacle in front of and below the eye, which is perfectly distinct; diameter of body 20 to 25 times in total length; 85–95 circular folds, all complete	1. *annulatus.*
Tentacle in front of and below the eye, which is perfectly distinct; diameter of body 32 times in total length; 110–115 circular folds, all complete	2. *paulensis.*
Tentacle in front of and below the eye, which is very indistinct; diameter of body 46 times in total length; 133 circular folds, mostly interrupted on the dorsal and ventral lines	3. *brasiliensis.*
Tentacle in front of and close to the eye, and very slightly below it; eye more or less distinct; diameter of body 36 or 37 times in total length; 100–104 circular folds, all complete.	4. *hardyi.*

*1. Siphonops annulatus.

Cæcilia annulata, Mikan, Delect. Flor. Faun. Bras. p. —, pl. — (1820); Spix, Serp. Bras. p. 74, pl. xxvi. fig. 1 (1824).

Siphonops annulatus, Wagl. Isis, 1828, p. 740, pl. x. figs. 1, 2; Dum. & Bibr. viii. p. 282, pl. lxxxv. fig. 1 (1841); A. Dum. Mém. Soc. Cherb. ix. 1863, p. 317; Peters, Mon. Berl. Ac. 1879, p. 940; Bouleng. Cat. p. 102, pl. viii. fig. 4 (1882).

Siphonops interrupta, Gray, Cat. p. 59 (1850).

Guianas; Brazil; Ecuador; Peru.

*2. Siphonops paulensis.

Siphonops paulensis, Boettg. Kat. Batr. Senck. Ges. p. 62 (1892).

S. Paulo, Brazil.

3. Siphonops brasiliensis.

Siphonops brasiliensis, Lütk. Vid. Meddel. 1851, p. 54 (1852); Reinh. & Lütk. Vid. Meddel. 1861, p. 202; Bouleng. Ann. & Mag. N. H. (6) viii. 1891, p. 457.

Dermophis ? brasiliensis, Peters, Mon. Berl. Ac. 1879, p. 938; Bouleng. Cat. p. 99 (1882).

Brazil.

*4. Siphonops hardyi. (Plate XXIV. fig. 3.)

Siphonops hardyi, Bouleng. Ann. & Mag. N. H. (6) i. 1888, p. 189, and viii. 1891, p. 457.

Porto Real, Prov. Rio Janeiro, Brazil.

14. Bdellophis, g. n.

Squamosals separated from the parietals. A single series of teeth in the lower jaw. Tentacle obtusely conical, exsertile, surrounded by a circular groove, in front of and below the eye, twice as distant from the nostril as from the eye. Body much flattened. No scales.

*1. Bdellophis vittatus, sp. n. (Plate XXIV. fig. 4.)

Teeth very small. Snout depressed, rounded, strongly projecting; eye small, distinct, much lower down than the nostril. 125 circular folds, interrupted on the dorsal and ventral lines. Tail indistinct, rounded. Bright yellow, with a broad black dorsal band.

Total length 160 millim.; greatest diameter of body 6 millim.

A single specimen from Usambara, German East Africa; received from Dr. F. Werner.

15. GEGENOPHIS.

Gegenes (non Hübn.), Günth. P. Z. S. 1875, p. 577.

Gegeneophis, Peters, Mon. Berl. Ac. 1879, p. 932; Bouleng. Cat. p. 101 (1882).

*1. GEGENOPHIS CARNOSUS.

Epicrium carnosum, Beddome, Madras Month. Journ. Med. Sc. 1870, p. 176.

Gegenes carnosus, Günth. P. Z. S. 1875, p. 577.

Gegenophis carnosus, Bouleng. Cat. p. 101, pl. viii. fig. 3 (1882), and Faun. Ind., Rept. p. 518 (1890).

Wynaad; Travancore[1].

16. SCOLECOMORPHUS.

Scolecomorphus, Bouleng. Ann. & Mag. N. H. (5) xi. 1883, p. 48.

*1. SCOLECOMORPHUS KIRKII. (Plate XXIII. fig. 3.)

Scolecomorphus kirkii, Bouleng. *l. c.*; Günth. P. Z. S. 1892, p. 555.

Nyassaland.

Table showing Geographical Distribution.

	West Africa.	East Africa.	Seychelles.	S.E. Asia.	Trop. America.
Ichthyophis	...	...	...	2	
Dermophis	1	1	...	...	4
Hypogeophis	...	1	2		
Cæcilia	...	...	...	...	6
Rhinatrema	...	...	...	...	2
Geotrypetes	1				
Uræotyphlus	1	...	...	2	
Cryptopsophis	...	...	1		
Herpele	1	...	...	...	1
Gymnopis	...	...	...	...	4
Typhlonectes	...	...	...	...	3
Chthonerpeton	...	...	...	...	2
Siphonops	...	...	...	...	4
Bdellophis	...	1			
Gegenophis	...	...	...	1	
Scolecomorphus	...	1			
Total	4	4	3	5	26

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[1] A specimen from Kallar, Travancore, received from Mr. H. S. Ferguson, measures 280 millim.; diameter of body 9 millim.; 110 folds; uniform dark brown, somewhat paler beneath.

EXPLANATION OF THE PLATES.

Plate XXIII.

Fig. 1. *Cæcilia buckleyi*, Blgr., p. 407.
1*a*. " " Side view of head, ×3.
2. *Rhinatrema bicolor*, Blgr., p. 407.
2*a*. " " Side view of head, ×2.
2*b*. " " Lower view of anterior end.
2*c*. " " " posterior end.
3. *Scolecomorphus kirkii*, Blgr., p. 413. Upper view of anterior end.
3*a*. " " Side view of head, ×2.
3*b*. " " Lower view of anterior end.
3*c*. " " " posterior end.

Plate XXIV.

Fig. 1. *Geotrypetes petersii*, Blgr., p. 408. Upper view of anterior end.
1*a*. " " Side view of head, ×2.
1*b*. " " Lower view of posterior end.
2. *Cryptopsophis multiplicatus*, Blgr., p. 409. Upper view of anterior end.
2*a*. " " Side view of head, ×2.
2*b*. " " Lower view of posterior end.
3. *Siphonops hardyi*, Blgr., p. 412.
3*a*. " " Side view of head, ×3.
4. *Bdellophis vittatus*, Blgr., p. 412.
4*a*. " " Side view of head, ×2.

2. On a new Species of the Genus *Erinaceus* from Somaliland. By John Anderson, M.D., LL.D., F.R.S., F.Z.S., &c.

[Received May 20, 1895.]

The Hedgehog, the subject of this description, is an adult female. It was living when presented to this Society on the 24th April, 1893, by Mr. H. W. Seton-Karr, F.Z.S., but died soon afterwards. When it was received at the Gardens it was regarded as an example of *E. albiventris*, Wagner[1], a species which is distinguished from all other members of the genus by having only four digits on the hind foot. The Somali Hedgehog, however, has five well-developed toes.

Mr. Sclater, being aware that I was interested in this genus, in connection with my Egyptian researches, was so good as to entrust the specimen to me for description, now some time ago.

I may mention that I have examined all the Hedgehogs preserved in the Museums of Paris, Frankfort on the Main, Munich, Berlin, and London[2], and, owing the kindness of Mr. Ludwig Lorenz, have had the opportunity of examining, in London, some of the specimens described by Fitzinger, preserved in the Vienna Museum.

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[1] *Cf.* Sclater, P. Z. S. 1893, p. 435.

[2] I embrace this opportunity to express my indebtedness to Professor R. Hertwig, Munich; Professor Dr. Boettger, Frankfort on the Main; Professor Möbius and Mr. Paul Matschie, Berlin; Prof. A. Milne-Edwards, Paris; and to Mr. Oldfield Thomas, for the facilities they have afforded me to study the specimens under their respective charges.

After a careful consideration of all the materials which have come under my observation, I have arrived at the conclusion that this Hedgehog from Somaliland belongs to a species new to science. I have found, in the British Museum, the skin of the body (spines only) of a Hedgehog from Taf, in Central Somaliland, which seems to be identical with it. The registered number of this specimen is 85.12.10.2.

I propose to designate the new species *E. sclateri.*

It belongs to that section of the genus in which the pterygoid fossæ are well-developed, and in which the pterygoids do not contribute to the enlargement of the auditory chamber of the macerated skull. The following species, besides *E. sclateri,* fall under this division, viz., *E. europæus*, Linn., *E. concolor*, Martin, *E. algirus*, Duv. & Lereboullet, *E. frontalis*, Smith, *E. auritus*, Pallas, and those which are doubtfully distinct from the last, *e. g.*, *E. grayi*, Bennett, *E. megalotis*, Blyth, and *E. allulus*, Stoliczka; and, finally, *E. albiventris*, Wagner, in which the hallux is absent, is also a member of this group. In the second section of the genus the pterygoid fossæ almost disappear, the pterygoids being enlarged and bullate, the cavity contributing to the enlargement of the auditory chamber of the prepared skull. The Hedgehogs which present this type of cranial structure are *E. micropus*, Blyth, *E. pictus*, Stoliczka, *E. æthiopicus*, Ehrenberg, and *E. macracanthus*, Blanford.

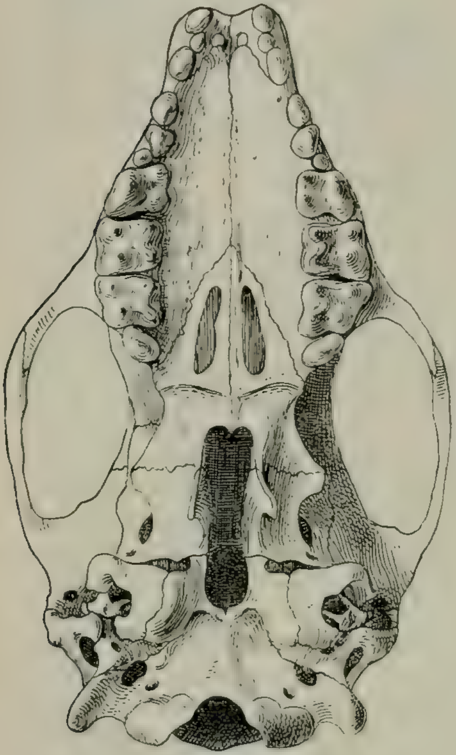
The Hedgehogs of the first section are referable to two subdivisions, depending on the nature of the post-glenoid process of the squamous. In one that process is solid and much smaller than the mastoid, whereas in the other it is as large as the mastoid process, and concave internally, but not bullate.

The following species, viz., *E. europæus*, *E. concolor*, *E. algirus*, *E. frontalis*, *E. sclateri*, and *E. albiventris,* fall under the first of these subdivisions, and *E. auritus* and its allies already mentioned under the second.

All Hedgehogs belonging to the first subdivision, and of which *E. europæus* may be regarded as the representative, have an area from the forehead to the nape devoid of spines. Their spines are perfectly smooth, that is they have no longitudinal ridges, and are circular in transverse section. They present, however, a finely striated appearance externally, due to the cells of their cuticular covering. In the Hedgehogs of the second subdivision there is no bare area on the mesial line of the head, and the spines are covered with longitudinal ridges bearing minute nodosities.

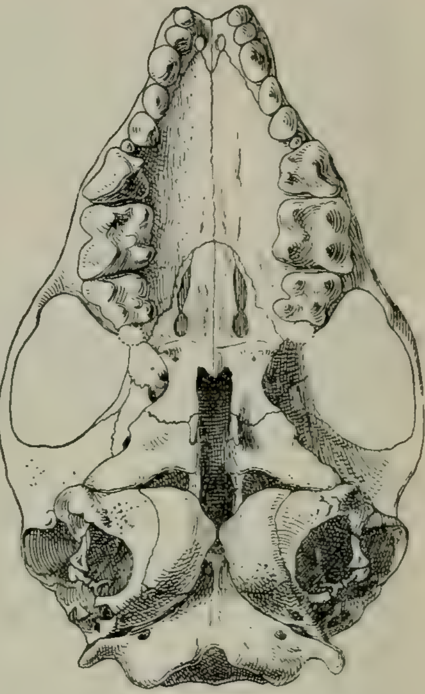
In the second great section of the genus with dilated pterygoids the post-glenoid process of the squamous becomes greatly enlarged antero-posteriorly, and hollowed out into a large bullate cavity continuous with the auditory chamber of the macerated skull. The Hedgehogs belonging to this type of skull, and of which *E. æthiopicus* may be regarded as the highest expression, have a bare area on the mesial line of the head and strongly ridged and nodose spines[1].

Fig. 1.



E. sclateri, And.

Fig. 2.



E. æthiopicus, Ehr.

It has been stated by Dobson, and repeated by others, that the spines of all the known species are marked by longitudinal ridges; but if the spines of *E. europæus* and its allies be subjected to microscopical examination in cross section, it will be found that they have a perfectly circular outline without any trace of longitudinal ridges, whereas if a spine of *E. æthiopicus* be treated in the same way the cross section is seen to be thrown into alternate risings and depressions, due to the presence of longitudinal ridges. The cavity of a spine of either of these groups in cross section consists of a number of inwardly projected septa enclosing chambers. In spines with ridges and furrows, the septa always correspond to the latter, *i.e.* they originate from the inner walls, whereas the ridges are outward bulgings of the chambers defined by the septa. The position of the latter (septa) is generally indicated externally by a dark longitudinal line, due to the greater thickness of the periphery of the spine opposite to a septum. It is the presence of these dark longitudinal lines that has doubtless given rise to the erroneous impression that they are ridges. The number of septa in the spines of a species is subject to considerable variation—in *E. sclateri* the lowest number being 21 and the highest 26, but, among spines of 88 specimens of the genus, I have found the variation to be even greater than this.

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[1] I give an enlarged view of the skull of *E. sclateri* and alongside of it one of *E. æthiopicus*, to bring out the cranial features of the two groups.

The fur of this species has the coarse texture of *E. europæus*, and distinctive of all the smooth-spined Hedgehogs, whereas in the ridged-spined forms the hair is soft and silky.

In *E. sclateri*, as in all the existing species of the genus, with the exception of *E. europæus* and *E. pictus*, the third upper incisor has two roots. In the former it has always one, but in the latter the condition of the teeth varies, as in three out of four skulls the third upper incisor has only one root; but this is probably due to the union of two roots, or to incipient division, as the root in these teeth is marked by a longitudinal furrow on each side. In the fourth skull the tooth has two distinct roots.

This species (*E. sclateri*) has a double-rooted canine, which is the general character of this tooth throughout the genus. In *E. europæus*, however, the canine has usually only one root; but there are exceptions, as in five out of fifteen individuals observed by me it has two roots, while in the widely different *E. pictus* one out of four specimens examined has the tooth with only one root. The instability of the rooting of this tooth is further evinced by a skull of *E. europæus* in which the canine has a single root on one, and two roots on the opposite side. In *E. concolor*, which is very closely allied to *E. europæus*, the canine has two roots, as in *E. algirus*.

In *E. sclateri* the first upper premolar, as in *E. algirus*, *E. frontalis*, *E. albiventris*, *E. æthiopicus*, and *E. macracanthus*, has two roots; whereas in *E. europæus*, *E. concolor*, *E. pictus*, and *E. micropus* it has usually one root. On the other hand, in the forms that can be grouped with *E. auritus*, such as *E. megalotis* and *E. grayi*, the first upper premolar may have either one or two roots.

The second upper premolar of *E. sclateri* has three roots, which is the general character of this tooth throughout the genus, with the exception of those species in which it is very feebly developed and occasionally shed even before the other teeth become worn, and in which it has only a single root. These species are *E. micropus*, *E. pictus*, and also *E. æthiopicus*; but in the last I have met with an example with a double-rooted second upper premolar. Among the species in which it generally has three roots exceptions also occur, as Dr. Scully has recorded an instance (*E. megalotis*) in which only two roots are present, and I have observed three similar cases in *E. grayi*, a species which with *E. megalotis* may, possibly, be ultimately regarded as only varieties or local races of *E. auritus*—an opinion which has already been expressed by Dobson.

The following are the external characters of this species:—

Snout short; ears broadly rounded, but not so high as the interaural spines. Feet well developed; pollex twice as large as the hallux. Two large pads below the wrist, placed side by side, the external pad the larger. The fifth toe twice as large as the hallux;

a large lingulate pad on the middle of the plantar surface, which is sparsely covered with hair from the heel to the pad. Claws moderately long. Tail short, about half the length of the hind feet. Spines finely striated, the longest about 18 millim. in length and 1 millim. in diameter. The inter-aural spines are not quite so long as the longest body-spines.

The apices of the spines are generally yellowish white, passing into a narrow orange-yellow band, which merges into a brown band followed by a broad yellowish or white band, the basal ends of the spines being dusky.

The face anterior to the eyes, and the chin, are nearly nude, the skin of these parts having a livid hue and sparsely covered with minute dusky hairs, those along the margin of lips being whitish. The ears also are nearly nude, of a livid hue, and are only sparsely clad with short hairs. The fore and hind limbs are thinly clothed with brownish and yellowish hairs. The lower part of the belly and the area behind it are covered with brownish fur. The head behind the livid snout and chin, the sides of the body below the spines, the throat, chest, and upper part of the abdomen are all yellowish white.

	millim.
Snout to vent	122·0
Vent to tip of tail	14·5
External meatus to snout............	41·0
Snout to eye	21·5
Height of ear	24·0
Length of fore foot	18·0
,, of hind foot	28·5
,, of pollex	2·5
,, of hallux	1·6

The skull of *E. sclateri* is much smaller than that of *E. frontalis*, Smith, the only species, next to *E. algirus*, with which it can be compared, but it is more closely allied to the former than to the latter. The difference in size between the skull of the British Museum specimen of *E. frontalis*, Smith (*E. diadematus*, Dobson, but not of Fitzinger), which is a male, and that of *E. sclateri*, which is a female, is greater than mere sexual dissimilarity would account for. It should be viewed in connection with the differences that exist between the two animals when their external characters are studied, and which are such that I have had no course left me but to regard them as specifically distinct.

In *E. frontalis* the spines between the ears instead of being rather shorter than the body-spines, as in *E. sclateri*, are decidedly longer and form an eminence between the ears. It has only a single large pad below the wrist, whilst in *E. sclateri* there are two placed side by side. The hind foot of *E. frontalis* has an acutely pointed, well-developed, nipple-like tubercle, opposite to the hallux, whereas in *E. sclateri* there is a broadish flat lingulate pad in a similar position. The ears also of *E. frontalis* are not so rounded as those of *E. sclateri*. The longer spines of *E. frontalis* have exceedingly narrow yellowish tips, with a very broad dark brown band below them, so that the animal has a dark colour, almost like *E. collaris* of India; whereas in *E. sclateri* the spines are broadly tipped with white succeeded by a brown band, but not so broad or dark as in *E. frontalis*, so that the coloration of this Hedgehog is nearly white, but with an orange-brown tint. In *E. frontalis* the face from behind the angle of the mouth, through the eye, and between the eyes to the nose is russet-brown. The shoulder, fore limbs, a band across the chest, the body, and hind limbs are dark russet-brown; the remaining parts, viz., the forehead, the front of the ears, the side of the neck, and the chest behind the brown pectoral band, are white. By these differences in coloration the two species are at once distinguished from one another, while their specific distinctness is established by the other structural dissimilarities already enumerated.

This species is only known from Somaliland.

This genus is represented in Africa by six species, viz., *E. algirus*, Duv. & Lereboullet, *E. frontalis*, A. Smith, *E. sclateri*, *E. albiventris*, Wagner, *E. æthiopicus*, Ehr., and *E. auritus*, Gmelin; and the following is their synonymy and distribution:—

1. Erinaceus algirus, Duv. & Lereb.

Erinaceus algirus, Duv. & Lereboullet, Mém. de la Soc. du Mus. d'Hist. Nat. de Strasbourg, iii. (1840) pp. 4–5; Dobson, Monogr. Insect. pt. i., Jan. 1882, p. 12 (external characters only); Lataste (F.), Act. Soc. Bordeaux, xxxix. (1885) p. 200; Explor. Sc. de la Tunisie, Cat. Crit. des Mammif. 1887, p. 5, et Suppl. pp. 39–41.

Erinaceus krugi, Peters, SB. Ges. naturf. Fr. Berlin, 1877, p. 78; Dobson, op. cit. pp. 11, 12.

Erinaceus fallax, Dobson, op. cit. pp. 9, 10.

Erinaceus deserti, Dobson, op. cit. pp. 12, 13 (cranium).

Distribution. Tripoli, Tunisia, Algeria, and Marocco (Tetuan).

2. Erinaceus frontalis, A. Smith.

Erinaceus capensis, Andrew Smith, Phil. Mag. & Annals of Phil. vol. ix. Jan.–June 1831, pp. 61, 62 (nomen nudum).

Erinaceus frontalis, Andrew Smith, South Afr. Quart. Journ. vol. i. (1830) no. 5, Oct. 1831, p. 10; ibid. vol. ii. Dec. 1833, p. 61; Ill. of South African Zoology, 1849, plate iii. (♀); Bennett, Proc. Zool. Soc. ii. (1832) p. 193; Wagner, Säugeth. Suppl. vol. ii. (1841) p. 21; Fitzinger, SB. Ak. Wien, lvi. 1867, p. 854.

Erinaceus capensis, Smith, T. Smuts, Diss. Zool. Enum. Mamm. Cap. 1832, p. 8.

Erinaceus diadematus, Dobson, op. cit. p. 10 (nec *E. diadematus*, Württemb., Fitz.).

Distribution. South-western Africa, Benguella to the Cape of Good Hope.

3. ERINACEUS SCLATERI, n. sp.

Distribution. Somaliland.

4. ERINACEUS ALBIVENTRIS, Wagner.

Erinaceus albiventris, Wagner, Säugeth. Suppl. vol. ii. 1841, p. 22; Dobson, op. cit. p. 11.

Erinaceus pruneri, Wagner, Säugeth. Suppl. vol. ii. 1841, p. 23.

Peroëchinus pruneri, Fitz. SB. Ak. Wien, t. lvi. 1867, p. 856.

Peroechinus albiventris, Fitz. SB. Ak. Wien, t. lvi. 1867, p. 857.

Erinaceus heterodactylus, Sundevall, Vetensk.-Akad. Handl. (1841), Stockholm, 1842, p. 227.

Erinaceus diadematus, Prinz Paul, Rüppell, Mus. Senck. t. iii. (1845) p. 159 (nomen nudum); Fitz. SB. Ak. Wien, t. lvi. 1867, p. 853.

Erinaceus adansoni, de Rochebrune, Bull. Soc. Philom. Paris, (7) t. vii. 1883, p. 7.

Distribution. Senegambia across Central Africa, southwards to Ukamba and northwards to Somaliland.

This species has been obtained in the following localities:—Senegal; Saint Louis; Cape Verd; Joal; MacCarthy's Island, River Gambia; Accra, Fantee; Porto Seguro, Togo; Gaboon; Kitui, Ukamba; Tabora; Kasé; Kilima Njaro; Wakilomi, District of Maka; Central Somaliland; Sennaar; Kordofan; and region of Upper Nile.

5. ERINACEUS ÆTHIOPICUS, Ehrenberg.

Erinaceus æthiopicus, Ehr. Symbolæ Phys. Decas ii. 1832.

Erinaceus auritus, Rüppell (non S. G. Gmelin), Neue Wirbelth. 1835, p. 40, in part; Tristram, Survey of West Palestine, 1884, p. 24.

Erinaceus senaarensis, Hedg. Isis, 1839, p. 5.

Erinaceus brachydactylus, Wagner, Säugeth. Suppl. ii. 1841, p. 24.

Hemiechinus pallidus, Fitzinger, SB. Ak. Wien, 1867, p. 866.

Erinaceus platyotis, Dobson (nec Sundevall), op. cit. p. 12.

Erinaceus deserti, Loche, Cat. Mammif., &c., de l'Algérie, 1858, p. 20; Dobson, op. cit. pp. 12, 13 (nec cranium); Lataste, Act. Soc. Bordeaux, xxxix. 1885, p. 202; Explor. Sc. de la Tunisie, Cat. Crit. des Mammif. 1887, p. 5, et Suppl. pp. 39–41.

Erinaceus algirus, Dobson, op. cit. p. 12 (cranium).

Distribution. Upper Nile Valley, Sennaar to Abyssinia, the Red Sea littoral (Suakin), and northwards to Nubia (Dongola).

6. ERINACEUS AURITUS, S. G. Gmelin.

Erinaceus auritus, S. G. Gmelin, Nov. Comment. Petrop. xiv. 1770, p. 519, tab. xvi.; Pallas, ibid. p. 573, tab. xxi. fig. 4; Geoffroy St.-Hilaire & Audouin, Descr. de l'Egypte, Hist. Nat. ii. (1827) pp. 737–739, pl. 5. fig. 3; Audouin, ibid. pp. 745, 746, Suppl. pl. i. (skull and teeth); Dobson, Monogr. p. 16.

Erinaceus libycus, Hempr. & Ehr. Symb. Phys. Decas ii. 1832; Dobson, Monogr. p. 16 (nec syn.).

Erinaceus hypomelas, Brandt[1], Bull. Ac. St. Pétersb. 1836, p. 32.

Erinaceus platyotis, Sundevall[2], Vet.-Ak. Handl. Stockholm, (1841) 1842, p. 232.

Erinaceus ægyptius, Geoffroy[3], Rüppell, Mus. Senck. iii. 1845, p. 159.

Erinaceus frontalis, Dobson (nec *E. frontalis*, A. Smith), Monogr. p. 18.

Erinaceus brachydactylus, Tristram (not Wagner), Survey of Western Palestine, 1884, p. 25; Hart, Fauna & Flora of Sinai Petra, &c. 1891, p. 238, pl. i. fig. 2.

Distribution. Lower Egypt; Sinaitic Peninsula; Palestine; Cyprus; Turkey in Asia to Kirghis Steppes.

In Africa it is confined to Lower Egypt.

3. Note on the Structure and Habits of the Sea-Otter (*Latax lutris*). By R. LYDEKKER.

[Received April 9, 1895.]

Through the kindness of Mr. J. Cole Hartland, of Yokohama, I have received the following notes on the structure and habits of the Sea-Otter made by Mr. H. J. Snow, who for the last twenty years has been engaged in hunting these animals and fur-seals in the Kurile Islands. As they somewhat revolutionize the current ideas as to the position of the hind limbs, I think they are decidedly worth laying before the Society.

Commenting on a reproduction of Wood's well-known figure given on page 98 of the second volume of 'The Royal Natural History,' Mr. Hartland writes me that "The fore limbs are much shorter than represented, and when on shore the chest, as far as the end of the breast-bone, has the appearance of almost touching the ground. The abdomen is raised considerably from the ground and the hind flippers are doubled back, the Sea-Otter being incapable of placing its hind flippers in the position represented in the drawing. It occurred to Mr. Snow that the illustration may have been taken from a specimen shot by himself and set up by Ward of Rochester, New York, photos of which I enclose. The attitude of this specimen is quite misleading, and not at all that assumed by the animal when on shore. Mr. Snow has had several opportunities of getting good observations of these animals when on shore—on one occasion he saw some 20 or more on a rocky point of one of the Kurile Islands, and succeeded in killing 9 of them. Their mode of locomotion is by a series of short springs from the hind flipper—he never saw them *walk* in ordinary acceptance of the term, *i. e.* by moving the limbs alternately. With regard to the *tail*—it is *not* cylindrical but *flattish*, being more than twice as broad as it is thick. It only tapers to a very slight extent, except at the extreme end, where it runs off sharply to a bluntish point.

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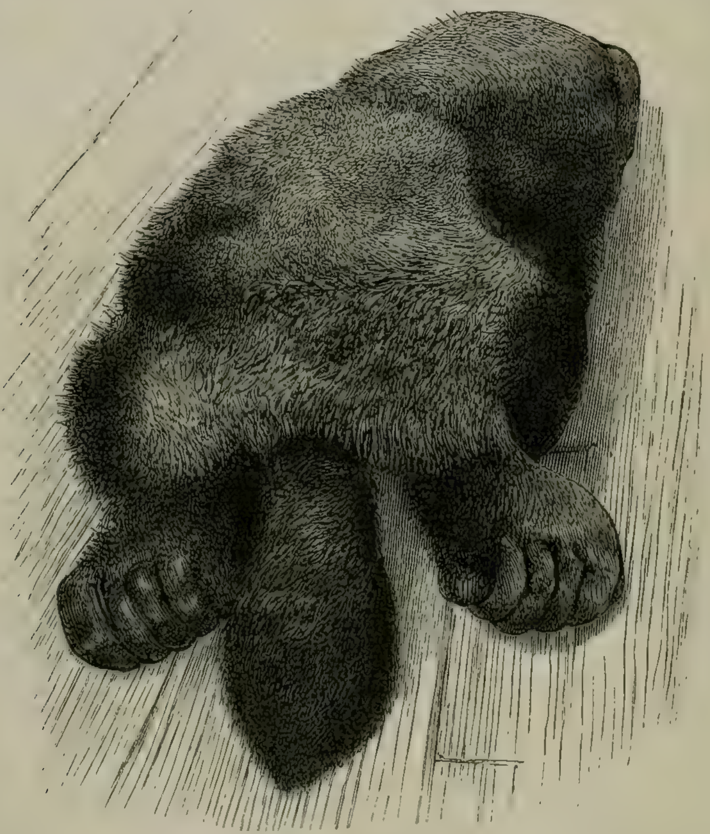
[1] Prof. Büchner has been so good as to inform me that the spines on the head of the type are not divided into two lateral groups by an area destitute of spines, and that the spines are distributed quite as in *E. auritus*.

[2] I am indebted to Prof. F. A Smith, of Stockholm, for the information that in the type there is no bare area on the mesial line of the head, and also for the opportunity to examine some of the spines of Sundevall's specimen.

[3] This name is taken from the unpublished Catalogue of Mammals in the Paris Museum, by (Étienne) Geoffroy St.-Hilaire.



Latax lutris.

Dead Sea-Otter lying on deck; it exhibits the short tail, and the hind paws turned backwards, in the manner said to be natural to the animal when walking.

The whiskers are not so bushy and thick as represented in the drawing. They resemble the whiskers of the Cat, but are coarser. The cry of the Sea-Otter resembles the 'meaow' of a Cat; that of the young is almost identical, but in the adult it is somewhat deeper.

"*Habitat.* The southern limits of the animal extend as far as Southern California and Mexico. On the Asiatic side, it occurs at the Komandorski Islands, Kamschatka, and the Kurile Islands.

"*Breeding.* As a rule but one is produced at birth, but occasionally two. Mr. Snow has seen two small pups with their mother,

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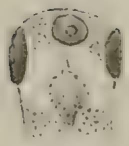
P. Z. S. 1895. Pl. XXV.



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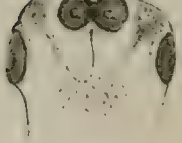

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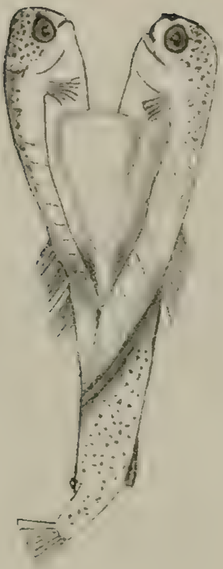

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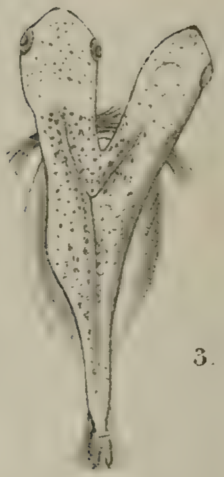

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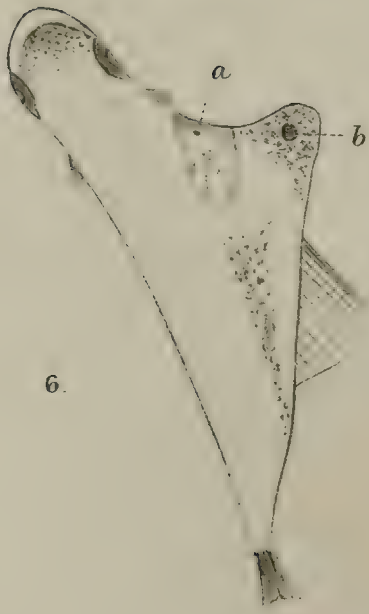

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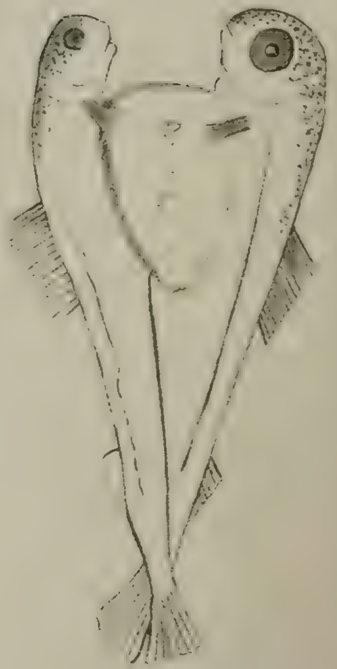

5.

J. Smit lith.
Mintern Bros. imp.

MALFORMATIONS OF FISHES.

and has taken two from the inside of an Otter he killed. It is not absolutely known at what age the Otter arrives at maturity; Mr. Snow believes that they do so in the third year.

"*Habits.* Crabs and sea-urchins are the usual contents of the stomach, but occasionally small fish and spawn are also found. The crabs are crushed by the strong molar teeth; it being impossible that the crushing is produced by the striking of two shells together in the manner described by Elliot, as the form of the fore feet will not allow of anything being grasped. The Otter dives for its food and returns to the surface with the prey held between its two fore paws, in which it continues to hold it while eating it. On many occasions Mr. Snow has seen schools of from 10 to 50 or more Otters together some 10 or 15 miles from any land, but not of late years.

"*Hunting.* The mode adopted by Europeans is to 'run' the Sea-Otter with three boats, each manned by 4 or 5 men, a hunter being in the bow armed with a rifle. When an Otter is 'raised' (as it is called) the boats proceed to surround it, lying some 500 to 600 yards apart in the form of a triangle. The boats are so manœuvred that the otter is kept between them. Every time the animal makes its appearance above water, it is shot at, until it is secured. When the Sea-Otter is netted, as described on page 101 of the volume cited, it becomes entangled in the meshes and drowned. The long white hairs of the fur, which are not removed in dressing, form its chief beauty."

Apart from the interesting account of the creature's habits, the especial importance of these notes is in regard to the doubling back of the hind feet, and the jumping motion in walking; in both of which respects the Sea-Otter appears to resemble the true Seals. I regret my correspondent has not sent me a photograph of the living animal; but the accompanying reproduction of a photograph of a recently killed specimen, as it lay on deck (p. 422), gives a good idea of the form of the hind feet and tail.

4. On Double Malformations amongst Fishes. By Bertram C. A. Windle, D.Sc., M.D., M.A., Professor of Anatomy in Mason College, Birmingham.

[Received May 10, 1895.]

(Plate XXV.)

I. *Introduction.*

The following observations are based upon the examination of about fifty trout-embryos presenting some grade, more or less advanced, of double monstrosity, and upon the descriptions of similar or allied forms to be met with in the literature of the subject, which I have endeavoured to examine as exhaustively as possible. As I shall have to allude to most of these papers in a later part of this communication, I shall here content myself with making mention of a few of the earlier notices on the point, to which I shall not again have occasion to revert. As far as I know the earliest description of a double fish is that given by Aldrovandus (**1**) :—"captus fuit," he says, "in Nilo Ægypti fluvio, non procul ab oppido Latislana cognominato. Hic piscis magnitudinem fere Crocodili adæquabat, coloris erat leucophæi albicantibus maculis insigniti. Habebat quidem duo capita etc." This description, which seems to be original to Aldrovandus, since I have been unable to find it in any of the other similar works which I have searched, must have been based upon the description of some double fish, perhaps a Shark, like that in the R. C. S. Museum. It must also have been enormously exaggerated, since there is no other description of a fish having lived to attain any but a small size. According to von Baer (**2**), Jussieu, in 1754 (**3**), exhibited to the French Academy two small fishes united by their bellies. In 1765, Jacobi (**4**) gave the first account of any importance of the double forms which he had observed in a fish-hatching establishment:—"En faisant éclore des truites," he says, "j'ai quelquefois remarqué quantité d'avortons ou de monstres, certaines années plus, d'autres moins. Quelques-uns avaient deux têtes et le corps bien formé ; d'autres avaient le ventre commun et du reste étaient deux poissons bien distincts comme seraient deux poissons ordinaires que l'on coucherait sur une table bien serrés l'un contre l'autre par le ventre." According to von Baer, Rudolphi (**5**), Heusner (**6**), and Rathke (**7**) have mentioned similar forms, but I have been unable to refer to the original papers.

II. *Observed forms of Duplicity.*

1. Three eyes of same size (Plate XXV. fig. 1). I have three specimens in which the head is somewhat broader than usual, and is provided with a third, median eye, which appears from external examination to be of the same size as those to each side of it. I have not found this condition, which seems to be the least manifestation of duplicity, mentioned in any of the papers to which I have referred.

2. Three eyes, the median being larger than either of the lateral. I have one specimen of this class. I have not examined the median eye by sectional method, but from its external appearance it appears to be composed of two eyes fused together.

3. Four equal-sized eyes. I have one specimen of this condition myself (fig. 2), and it has also been described by Knoch (**8**) and by Klaussner (**9**). In the instance given by the last-mentioned writer, the fish had two distinct heads, one of which was provided with two, the other with four eyes, the condition thus being one of triplicity. Knoch states that there may be two mouths in cases of the kind included in this class. Such is not the case in my specimen.

4. Two heads, the duplicity extending as far back as the otic region. None of my specimens fall into this class, instances of

which have been described by Knoch, von Baer, Klaussner, St.-Hilaire (**10**), and Lereboullet (**11**).

5. Duplicity extending to the region of the pectoral fins (fig. 3). I have several instances of this condition, which has also been described by von Baer and Rauber (**12**). In these cases, as can be seen when the yolk-sac is still present in the specimen, the division extends as far back as the anterior border of that appendage. I may here mention, as some stress has been laid upon that point by de Quatrefages (**13**), that, although I have carefully looked for it, I have never found any sign of a notch or fissure at the anterior border of the yolk-sac in these or any other of my specimens, such as he saw in some of his and believed to be an indication of the union of two originally distinct sacs.

6. Duplicity extends to the posterior border of the yolk-sac, the caudal extremity of the fishes being quite single (fig. 4).

7. Duplicity extends a short distance behind the posterior border of the yolk-sac, so that there is a triangular gap between the sac and the adjacent sides of the two bodies. The caudal extremity is, however, quite single. I have several specimens of each of the conditions described in this and the preceding class.

8. Duplicity extends to the posterior border of the yolk-sac. Behind this there are two caudal extremities overlapping one the other and firmly united by their contiguous aspects. Each is provided with a distinct and independent caudal fin, a point easily overlooked in a cursory examination, since one overlies the other (fig. 5). In these cases there are two vertebral columns; and from the relation of the caudal ends to one another, it would appear that at some period of development they had been separate, and had subsequently fused in part with one another. I have several specimens belonging to this class, and the condition has also been described and figured by Rauber.

9. Union by the caudal extremities alone. I have not seen this condition, which has been noted by Klaussner, Lereboullet, and Rauber.

10. Union is by the ventral aspects at the site of attachment of the yolk-sac (anakatadidymus). I have specimens of this class, which has also been described by de Quatrefages and Valentin (**14**).

In the above-mentioned cases the two portions, greater or smaller, of which the double monster consisted are of approximately the same size. As a matter of fact, the occurrence of two united fishes, each being of exactly the same size, must be an occurrence of some rarity. I find it in none of my specimens, and in by far the greater number of recorded cases the inferiority in size of one member is especially mentioned. There is, however, no such marked difference in size as is met with in another group, which should now be considered, that, namely, of

11. Parasites, as they may be called, adopting a term familiar to teratologists. In these cases one member is reduced to the condition of a mere appendage to the larger and more perfect half. A few instances of this condition may be briefly described from

amongst those in my collection (*a*, fig. 6). On the left side of the right fish, which is itself well-formed and normal in every way, and at about the site of the pectoral fins, there is a pointed projection, representing a second embryo. This projection is unprovided with branchia and has no mouth, but on its under surface there is a single median round patch of pigment, which, from its identity of appearance with certain other conditions yet to be mentioned, I take to be an ill-developed eye. (*b*) In this case the second fish, though much smaller than its normal fellow, is recognizable as a fish. It possesses a mouth and a normally formed right eye, that of the left side being represented by a circular patch of pigment like that alluded to in the first case. (*c*) In this case the head of the parasite has a mouth and is of a shape approximating to the normal, but possesses no eyes nor even pigment patches to represent them.

Lereboullet mentions an interesting case (series ii. no. 19), in which he was able to observe two stages in the development of a parasite. He says, "Je mis à part un œuf (de brochet) âgé de cinq jours, offrant une large bandelette embryonnaire normale avec son sillon; mais sur le côté droit de cette bandelette et tout près de sa base, on voyait se détacher du bourrelet blastodermique un très-petit tubercule, de forme triangulaire. La présence de ce germe accessoire partant du bourrelet blastodermique m'annonçait la production d'un embryon double, ou plutôt en raison de la petitesse du tubercule, un embryon muni d'une languette analogue à celles que j'avais vues précédemment. Cependant je ne revis cet œuf que huit jours plus tard. Le Poisson âgé de treize jours était éclos et très-agile. Il paraissait simple et régulièrement conformé; mais en l'examinant avec attention, je vis qu'il existait, au niveau de la nageoire pectorale du côté droit, un tubercule à peine sensible." From this observation it would appear that minor evidences of duplicity may be of more frequent occurrence than would be supposed, but so slight in their nature as to be easily overlooked.

Before leaving the subject of the various classes into which these double forms can be divided it may be well to note two points. In the first place, it should be observed that as yet no such form as that known to teratologists as katadidymus—a form, that is, in which two bodies are connected with a single cephalic extremity—has ever been described: a somewhat remarkable fact. And, lastly, mention should be made of a singular and most anomalous form described by Klaussner, in which two embryos quite divided from one another lay upon the same yolk-sac side by side, but with the cephalic end of one by the caudal end of the other. I have not seen or found in any of the papers to which I have referred any parallel to this case, which is difficult to account for by any of the theories of duplicity now holding the field.

III. *General Observations.*

1. Relative positions of the two members. The commonest position, as has been pointed out by Knoch, is side by side, but

this is because it is more common for the point of union to lie in front of the anterior limit of the yolk-sac than behind that appendage. When the separation between the two fishes extends further back, some form or another of torsion occurs, due to the gradual shrinkage of the sac, by which the relations between the two fishes are altered. Thus, if the separation extends to the posterior border of the sac only, the caudal end of the monster being single, that part will lie with its dorsal and ventral surfaces upwards and downwards, whilst the anterior parts will lie on their sides with their ventral aspects drawn towards one another by the contraction of the yolk-sac (see fig. 4). If, again, the separation is complete between the two fishes, the condition being that of anakatadidymus, both fishes will finally lie venter to venter in their entire length. Finally, where the separation of the caudal ends has been only temporary, as in the forms included in class 8, the cephalic ends, which are separate from one another, will lie with their ventral surfaces opposed, whilst the caudal ends are thrown one over the other and united in that position. From an examination of the numerous cases figured and described at all ages, it would appear that the embryos always at their earliest period of development lie side by side and that the subsequent changes in position of a part or the whole extent of their bodies are due to the influence of the contraction of the yolk-sac as it gradually becomes emptied of its contents.

2. Imperfections in one or both members of the double monstrosity. It has been already mentioned that in cases of parasitism the appendage is often very imperfectly developed, especially in connection with its mouth and eyes, and the same is true even in those instances in which there is no very remarkable difference in size between the two members. The following table of instances examined by myself will show this point quite clearly so far as regards the eyes :—

	Larger fish.		*Smaller fish.*	
	Right.	Left.	Right.	Left.
1.	Normal.	Normal.	Normal.	Absent.
2.	,,	,,	Choroidal fiss. unclosed.	Very small.
3.	,,	,,	Absent.	Absent.
4.	,,	,,	A pigment spot only.	,,
5.	,,	,,	,,	Normal.
6.	,,	,,	Absent.	Absent.
7.	,,	,,	Normal.	Lens with slight ring of pigment around it.
8.	,,	,,	A pigment spot only.	Absent.
9.	,,	,,	Normal.	A pigment spot only.
10.	,,	,,	Absent.	Absent.

In several instances also there is a considerable degree of mal-formation of the jaws, as in the following cases:—(*a*) In this case the smaller head was unprovided with eyes and the lower jaw was very short and tapered rapidly to a sharp point. (*b*) In this case the upper jaw was much shorter than the lower, which projected a long way in front of it: there was, in fact, an almost complete failure to develop of that portion of the head which is placed in front of the eyes. (*c*) In this case the condition was carried still further, for so extensive was the arrest of the development of the anterior part of the skull that the two eyes were placed quite close to one another, with scarcely any separation between them. These two last forms approximate to the condition known as cyclopia.

3. Frequency of occurrence. Jacobi, as has already been mentioned, stated that double monstrosities occurred more frequently in some years than in others; and I remember the late Mr. Burgess, the founder of the fish-hatching establishment at Malvern, making exactly the same remark to me, though he was unable to assign any cause for the variation. They have been met with amongst Sharks, Mackerel (**15**), Salmon, Trout, Perch, and Pike. I do not know whether any statistics have been drawn up at any of the fish-hatching establishments as to the percentage of double monsters to normal forms, but the following figures have been obtained from data in some of the papers to which I have referred:—

Observer.	Fish.	No. Examined.	No. of Double monsters.
Rauber.	Trout.	1000	2
	Pike.	325	1
Coste (**16**).	Various.	400,000	Over 100
Lereboullet.	Pike.	203,962	222

From the last figures, which are the most complete, it would appear that the percentage of occurrence in the pike is rather less than ·1, or about one per thousand.

With regard to the frequency of occurrence of the various classes into which I have divided these forms above, the distribution in the cases which I have examined myself is as follows:—

1.	Three eyes, all one size	3
2.	„ median being larger than others	1
3.	Four eyes	1
4.	Two heads	0
5.	Fission extending to the pectoral region	11
6.	„ extending to posterior border of yolk-sac	7
7.	„ extending beyond posterior border of yolk-sac	10
8.	Tails overlapping	9
9.	Union only by tails	0
10.	Anakatadidymus	2
11.	Parasitic	2

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EXPLANATION OF PLATE XXV.

Fig. 1. Head of trout-embryo, showing third median eye.
2. Head of trout-embryo, showing additional, median, pair of eyes.
3. Fission to region of pectoral fins. The left eye of the right fish is absent.
4. Fission to beyond posterior border of yolk-sac. The cephalic ends are twisted so as to lie venter to venter.
5. Fission with subsequent union of the caudal ends, which overlap one another. The tail-fins are double.
6. Parasitism. The specimen is seen from the ventral aspect and the parasite projects from the left side of the autosite as a pointed process. *a*, remains of yolk-sac; *b*, circular patch of pigment representing an eye.

5. On the Visceral and Muscular Anatomy of *Cryptoprocta ferox*. By FRANK E. BEDDARD, M.A., F.R.S., Prosector to the Society.

[Received May 21, 1895.]

(Plate XXVI.)

So far as I am aware there is no account of the anatomy of the "soft parts" of *Cryptoprocta ferox* in zoological literature, excepting only the brain, which was described by Dr. Mivart[1] from a drawing supplied to him by Prof. A. Milne-Edwards. Prof. Milne-Edwards himself, in conjunction with M. Grandidier, gave some years ago[2] a detailed account of the osteology of the animal; its external characters are of course well known[3]. Since some interest attaches to this animal as an aberrant Viverrine, I have thought it worth while to bring before the Society a few notes upon the anatomy of its viscera and muscular system. The individual which I dissected was a young male; the coloured drawing which I exhibit (Plate XXVI.) is not of that individual but of the fine adult now alive in the Society's Gardens. I am acquainted with only two coloured illustrations of the animal. The original drawing is contained in the first volume of our 'Transactions,'[4] and illustrates a paper by Mr. Bennett. The second figure is in the work upon Madagascar by Pollen and Van Dam[5]. Neither of these figures appears to me to be so satisfactory as the water-colour drawing by Mr. J. T. Nettleship, which I now place before the Society.

§ *Alimentary Canal.*

The *palate* has 8 ridges, of which the last three are more or less interrupted in the middle line; they here end in conical papillæ, of which there are plenty scattered between the ridges, and from a fusion between which the latter seem to have arisen.

The *tongue* (see woodcut, fig. 1) has two circumvallate papillæ on each side, of which the innermost is double. There is no median papilla. Contrary to what is said by Prof. Mivart, I have found them in *Genetta* (*pardina*). There is, as in the Cat, a strongly marked patch of spiny papillæ anteriorly.

The *stomach* is not unlike that of *Prionodon*, as figured by Dr. Mivart[6], though deeper. The interior of the cardiac portion is distinguished by numerous longitudinally running folds. These cease absolutely at the constriction which marks the commencement

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[1] "Notes on the Cerebral Convolutions of the Carnivora," J. Linn. Soc. vol. xix.

[2] "Observations anatomiques sur quelques Mammifères, &c.," Ann. Sci. Nat. (5) vii. p. 314.

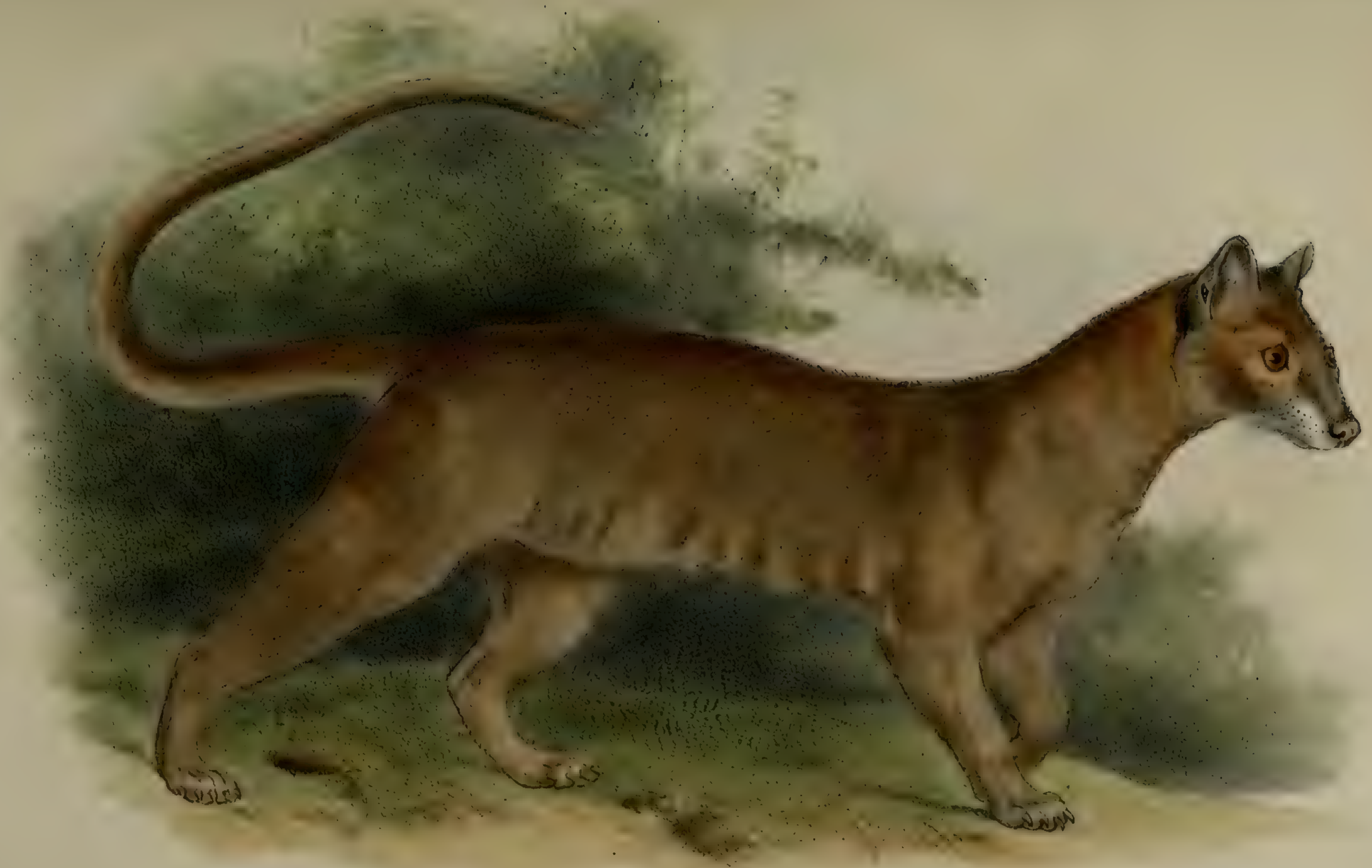
[3] See Bennett, Tr. Z. S. vol. i. p. 137; Pollen and Van Dam, "Recherches sur la Faune de Madagascar," 2e partie, vol. viii.

[4] Pl. xxvi.

[5] *Loc. cit.*

[6] P. Z. S. 1882, p. 506.

P.Z.S.1895.Pl.XXVI.



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CRYPTOPROCTA FEROX

BRITISH MUSEUM
Z S D
NATURAL HISTORY.

of the upward bend of the pyloric region of the stomach. The pyloric valve is not very strongly marked.

The *spleen* measures from end to end just over two inches. It is considerably wider at one end than the other. At the wide end are indistinct traces of bifurcation as in the Cat.

Fig. 2.

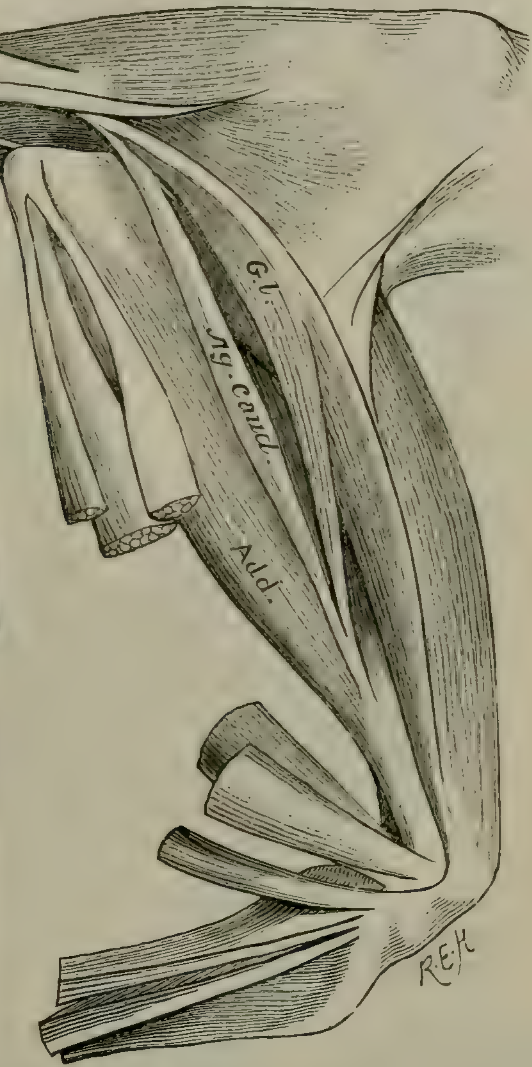


Fig. 1.

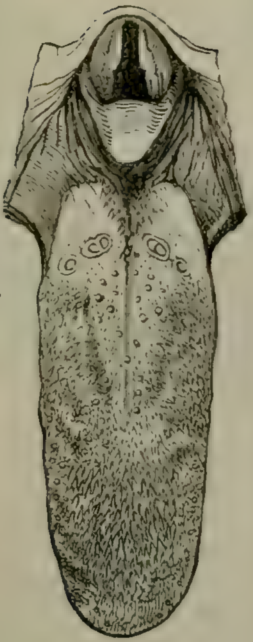


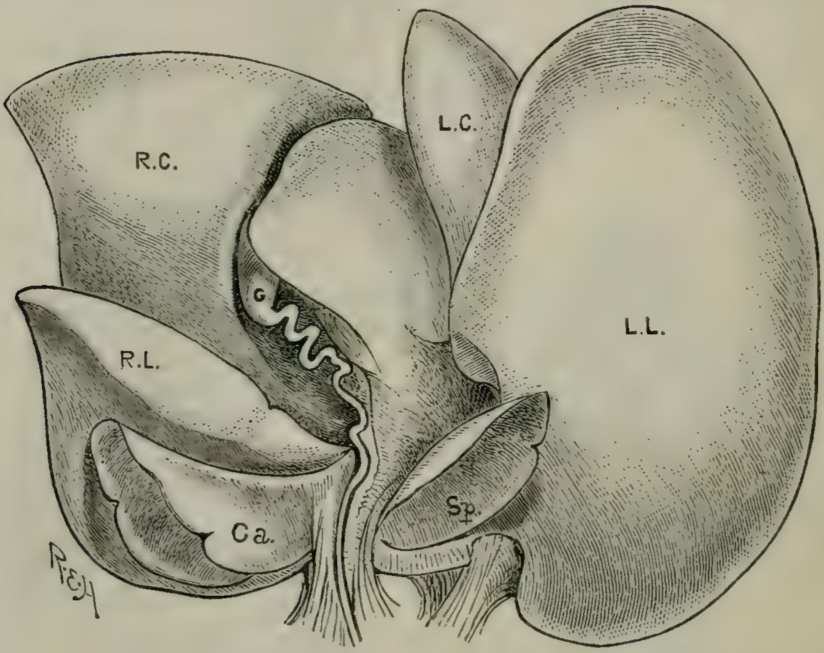
Fig. 1.—Tongue of *Cryptoprocta ferox*, dorsal surface.
Fig. 2.—Muscles of thigh of *Cryptoprocta ferox*.
G.l., gluteus maximus; *Ag. caud.*, agitator caudæ.

The small intestine measures 55 inches, the large intestine only $6\frac{1}{2}$ inches in length. There is a very long Peyer's patch, $4\frac{1}{2}$ inches in length, in the small intestine, which ends just at the origin of the cæcum.

The cæcum measures 10 mm. from the apex to the inner side of its junction with the intestine in a straight line. A median anangious sheet of mesentery connects it with the intestine and extends about halfway up it. A blood-vessel crosses the intestine on each side to supply the cæcum, but is not borne upon a mesentery. The cæcum is regularly conical in form, and slightly curved towards the small intestine.

The Liver.—The abdominal surface of the liver is shown in the accompanying drawing (fig. 3). All the 6 lobes are perfectly separate from each other. The Spigelian lobe is small and pointed.

Fig. 3.



Liver of *Cryptoprocta ferox*.

R.C., right central lobe; *L.C.*, left central lobe; *L.L.*, left lateral lobe; *R.L.*, right lateral lobe; *Ca.*, caudal lobe; *Sp.*, Spigelian lobe; *G.*, gall-bladder.

The right central lobe is nearly completely divided into two unequal halves by the furrow which lodges the gall-bladder. The relative sizes of the different lobes may be expressed by means of the following formula:—

$$\mathrm{LL}\ 2 > \mathrm{LC}\ 2 < \mathrm{RC}\ 3 > \mathrm{RL}\ 2 > \mathrm{Ca}\ 3 > \mathrm{Sp}.$$

For a comparison of the liver of this animal with that of other Ailuroidea I have referred to Dr. Mivart's paper upon the anatomy of the group[1]. The liver of *Cryptoprocta* agrees very closely with that of *Herpestes*, which is figured in the paper referred to. But no salient differences appear to distinguish the Viverrine from the Feline liver.

§ *Organs of Respiration and Circulation.*

The *lungs* are divided into four lobes on the right side and three on the left. The air-tube supplying the anterior of the right-hand lobes leaves the trachea just before its bifurcation; the middle lobe is served by a branch which springs from the bronchus just after the bifurcation. The bronchus itself supplies the two lower lobes. On the left side the two anterior lobes are supplied by a branch which arises from the left bronchus just at the bronchial bifurcation.

The *aortic arch* gives off an innominate vein and then the left subclavian separately. This appears to be the general arrangement in the Ailuroidea[2].

§ *The Brain.*

The brain after hardening in spirit measured 51 mm. in length by 35 mm. in diameter. The height is 26 mm.

It is well convoluted and characteristically carnivorous. I have paid careful attention to the convolutions, which, as is well known, are important in determining the affinities of carnivorous animals.

The brain of this animal has, however, already been described by Dr. Mivart in a memoir[3] dealing with the carnivorous brain generally. But, as his memoir contains no figures of the brain of *Cryptoprocta*, I have thought it worth while to have the accompanying drawings (figs. 4, 5) prepared. The brain agrees with those of other Carnivora (except the majority of the Cynoidea) in having three gyri—the Sylvian, parietal, and sagittal—arranged round the Sylvian fissure in the order mentioned. As in *Herpestes*, *Viverricula*, *Paradoxurus*, and *Cynictis* (but not *Genetta*), the posterior limb of the Sylvian gyrus is partially divided by a vertical fissure. As Dr. Mivart correctly surmised from the sketch lent to him by Prof. Milne-Edwards, the Sylvian fissure is prolonged back to join this latter fissure. This has happened, however, in my specimen only on the right side. In *Viverricula* and *Cynictis* it occurs on both sides. Though the parietal and sagittal gyri communicate posteriorly, as in *Paradoxurus*, there are faint indications of a separation, as I have shown in the drawing (fig. 4, p. 434). In *Paradoxurus* there are no such indications. There is, however, a resemblance to *Paradoxurus* in the commencing division of the anterior part of the sagittal gyrus lying behind the crucial sulcus by a deep but short fissure into two parts. There are fair traces of this in *Paradoxurus*; fainter traces in *Genetta* and *Viverricula*; none at all in *Herpestes* and *Cynictis*.

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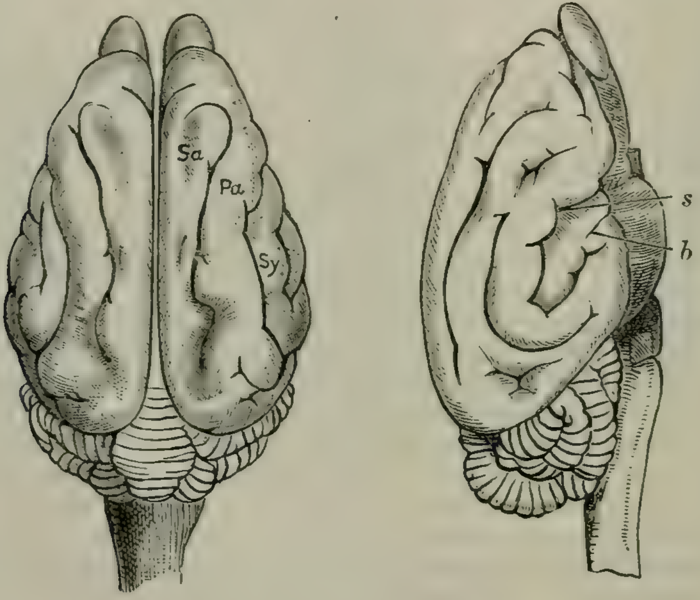
[1] "Notes on some Points in the Anatomy of the Ailuroidea," P. Z. S. 1882, p. 510.

[2] See Mivart, P. Z. S. 1882, p. 515.

[3] "Notes on the Cerebral Convolutions of the Carnivora," J. Linn. Soc., Zool. vol. xix. p. 1.

When the olfactory bulbs are gently pulled down from the anterior edge of the brain, they are seen to have covered a vertical furrow on each side, which are present in *Herpestes* and *Cynictis*. In *Paradoxurus*, *Genetta*, and *Viverricula* this fold is more laterally placed, so that it is not concealed by the olfactory bulbs. It will be seen from the brain of *Cryptoprocta* that there are indications of this furrow, which seems to show that it is not the homologue of the anterior one of *Herpestes*. Dr. Mivart has hinted that the Sylvian fissure may possibly not be that which I have identified with it in the present paper. In this case the brain will come to resemble that of the dog in having four gyri, and one of the two small fissures marked *b* in the drawing (woodcut, fig. 5) will be the Sylvian fissure.

Fig. 4. Fig. 5.



Brain of *Cryptoprocta ferox*.

Fig. 4.—Dorsal view.
Sa, sagittal gyrus; *Pa*, parietal gyrus; *Sy*, Sylvian gyrus.

Fig. 5.—Lateral view.
s, Sylvian fissure; *b*, post-Sylvian fissure.

It will be noticed that the anterior of the two fissures arises from the summit of the angle formed by the pallial fissure, which is in favour of its identification with the Sylvian fissure. On the right side of the brain, however, this fissure is only just indicated, the second of the two referred to being much the most prominent. In *Cynictis* the fissure in question is present and looks very like a Sylvian fissure ; so also in *Viverricula*. No doubt this is some reason for placing the three genera near to each other. The brain of *Herpestes pulverulentus* also offers some support to the veiw that the fissure *b* is the Sylvian fissure ; for in this species (and in other species, according to Mivart) the anterior limb of the Sylvian fissure is divided as in the Cats. There is therefore no antecedent improbability in this being the case with *Cryptoprocta*.

§ *Muscles of the Limbs.*

In studying the muscular anatomy of *Cryptoprocta*, I have used for comparison *Genetta pardina*, besides the work by Dr. Mivart upon the Cat and his memoir upon the Ailuroidea. Where the *Cryptoprocta* diverges in the characters of its muscular system from *Felis* it approaches, or is identical with, the *Viverridæ*, as will be gathered from the following notes upon the principal muscles of the limbs.

Of the muscles of the fore limb I only noticed that two were different from those of *Genetta pardina*. In the latter the *latissimus dorsi* is peculiar, in that it gives off a thin branch from near where its origin encroaches upon that of pectoralis major, which is inserted on to the head of the humerus close to the origin of the biceps. Just before the origin of the dorso-epitrochlear a wide slip is given off to pectoralis major. This latter seems to correspond to the blending "with adjacent fibres of the fourth part of the pectoralis" described by Dr. Mivart in the Cat.

These additional slips are not present in *Cryptoprocta*, which, like the Civets, has but one dorso-epitrochlear.

The other difference concerns the *extensor minimi digiti*. I found that this muscle in the *Cryptoprocta* supplied digits iii., iv., and v., the slip to v. being for a long way up a separate muscle. In *Genetta pardina* it only supplied iv. and v. But the distribution of the tendons of this muscle is evidently variable ; for while Dr. Mivart found that in the specimen of *Genetta tigrina* dissected by himself the muscle gave off tendons to all three digits, he quotes Cuvier to the effect that in "the Genet" only iv. and v. receive tendons.

The *biceps* has but one head, as is the rule with these Carnivora.

The *teres major* is inserted distinctly in common with the *latissimus*.

The *triceps* appeared to me to be rather four-headed, as in *Viverra civetta*, than five-headed, as in the Genet.

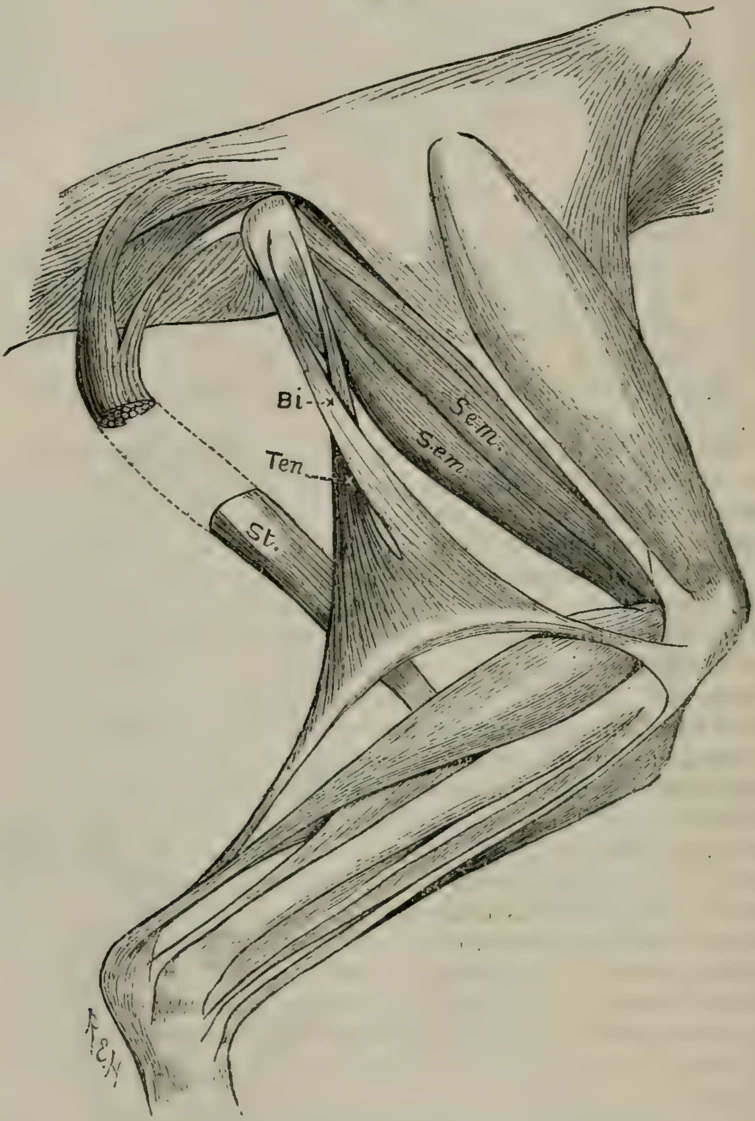
The *flexor sublimis* gives off a tendon to the *flexor profundus*. It supplies the three middle digits only.

The *flexor profundus* has four rather than five bellies; five if the connection with the flexor sublimis be counted.

The *extensor secundi internodii pollicis* supplies digits i. and ii.

Both in the fore limb and in the hind limb the muscles of the *Cryptoprocta* were easy to dissect, owing to the absence of strong fasciæ; this is perhaps related to the youth of the individual.

Fig. 6.



Muscles of thigh of *Cryptoprocta.*

Bi., biceps; *Sem.*, semimembranosus; *Ten.*, tenuissimus; *St.*, semitendinosus.

One of the most interesting muscles of the hind limb is the *semimembranosus* (see fig. 6). In the Cat it is partly divided into two parts; in the Genet the "two parts are more separate." Finally, in *Cryptoprocta* the two parts are absolutely separate, save for an extremely minute tract at their origin. The two parts of the muscle are equi-sized. The part which arises from the tuberosity of the ischium is tendinous at origin and is inserted on to the tibia.

The *semitendinosus* has the same double head of origin that characterizes the Genet and Civet, as is shown in the accompanying drawing, where the muscle is cut and reflected. The two parts join nearly halfway down femur, and there is, as Prof. Mivart remarks of the Genet, a slight connection with the *tenuissimus*.

The *biceps* arises from the ischial tuberosity just below the semitendinosus; the *tenuissimus* arises a little way in front of it. The two join as is shown in the illustration (woodcut, fig. 6).

The *gracilis* is like that of the Cat.

The *sartorius* was not double; it is very wide at insertion.

In the *quadriceps femoris complex* all four parts were well developed and distinct; the origin of the *cruræus* goes right up to the neck of the femur.

An *agitator caudæ* (see fig. 2, p. 431) is present in *Cryptoprocta*, as in the Genet but not in the Cat. It is inserted into the femur by a longish attachment in common with a slender slip which is detached from the second part of the *glutæus maximus* (that part which is inserted on to the outer condyle of the femur).

The *gastrocnemius* is only two-headed, the two heads arising, of course, from the two condyles of the femur; from external condyle in common with outer head arises the *plantaris*. The *soleus* arises from the head of the fibula only.

There are no special remarks to offer upon the flexors of the foot, except to state that the *accessorius* is as in the Civet, and thus the *flexor brevis digitorum* is in one mass.

The *tibialis* is not double, except just in the tendon for a short distance.

The *extensor communis digitorum* goes to four digits; the tendons arise from the muscle in order of notation, but they all pass through the ligamentous loop at the ankle-joint together.

The *extensor longus hallucis* is close to the tibialis; its muscle, however, extends below the muscle of the tibialis; it supplies the hallux only.

All three *peroneals* are present with attachment as in the Cat.

6. List and Distribution of the Land-Mollusca of the Andaman and Nicobar Islands, with Descriptions of some supposed new Species. By Lieut.-Col. H. H. Godwin-Austen, F.R.S., F.Z.S., &c.

[Received May 21, 1895.]

I. Introductory Remarks, p. 438.
II. Table of Distribution, p. 441.
III. Notes and Descriptions of new Species, p. 446.

I. *Introductory Remarks.*

The molluscan fauna of the Andaman and Nicobar Islands has received, since their occupation, a considerable amount of attention at the hands of many good naturalists and collectors. The first collection was made in 1846 by the staff attached to the Danish frigate 'Galathea,' commanded by M. S. Bille, at the time Denmark was in possession of the Nicobar Group: this was described by Professor A. C. L. Mörch, of Copenhagen. This expedition, sent by King Christian VIII., was very well organized: there were three zoologists, Professors Behn of Kiel, J. Reinhardt of Copenhagen, and Kjellerup, two botanists, Drs. Didrichsen and Kampioner, and a geologist, Dr. Rink; the Prussian botanist Th. Philippi also became attached to the expedition.

Of the above, Prof. Reinhardt paid most attention to the Mollusca.

In 1858 the Austrian frigate 'Novara' visited the Nicobars, but no material addition was made to what had been already obtained there.

After the formation of our great penal colony at Port Blair, many other naturalists from time to time visited the Andamans, and received every possible assistance from the Chief Commissioners in charge. Among those who thus helped to swell the list of the Land-Shells we can record the names of Colonel Haughton, Ferdinand Stoliczka, V. Ball, J. Wood-Mason, Major Wilmer, &c.; and Benson described a good many species.

Through the kindness of nearly all these collectors I have been able to secure specimens. My brother, Harold Godwin-Austen, was for several years an Assistant-Commissioner at Port Blair, and visited many parts of the islands before unexplored; he collected for me and sent home a number of species preserved in spirit, which have proved of great value.

Lastly, I have had the very large collection formed by another Assistant at Port Blair, Mr. F. A. De Röepstorff, placed in my hands by his widow.

This officer was the son of the last Danish Governor of the Nicobars, subsequently ceded to Great Britain. He was an indefatigable collector, and he added many new species to the list. As Mörch states quite truly, Copenhagen was, one may say, at this time the capital of the science of conchology, it being sufficient to mention the names of Müller, Chemnitz, Spengler, Fabricius, and Regenfuss.

With this previous work and material I am enabled to give a very full list of what has been obtained there; it does not profess to be exhaustive, as I am aware that collections are constantly arriving in this country, but I trust the list will be useful for others to add to. For instance, I know of no Land-Shells having been found on either of the small volcanic islands, and it would be of great interest if any should occur, having reference to the means whereby such forms can be transported.

The difficulty of landing on many of these rocky islets, and of getting back to the ship, is so great that very few opportunities occur, and then the time on shore is very limited, so that a good deal has yet to be done. It is remarkable how very few species range beyond the islands on which they have been found; thus there are only 8 species common to the Andamans and Nicobars, while only 7 range on the south to Sumatra and Java, and only 5 north to Burmah. However, there is a distinct and close relationship in the past shown with Burmah and Arakan by so many closely allied species, and equally marked is the paucity of forms having an alliance with those of Peninsular India. Marked diversity of form and restricted range is displayed among the Operculates, in *Cyclophorus* especially, by the turbinate shells of *C. leai*, *C. foliaceus*, &c., while *Alycæus* and *Diplommatina* are very limited in species. No species of *Clausilia* has yet been recorded from the Andamans, and only three from the Nicobars, and they are very close allies.

The genus *Microcystina* is represented by several species; although *M. cryptomphala* from Lower Bengal was placed in it by me, yet, as its anatomy is not known, this extension of the range is not certain. Five species occur in Borneo, but the animal has yet to be examined.

The genus *Plectopylis*, so common in Burmah and N.E. India, is absent. It is interesting to note the occurrence of *Omphalotropis*, a genus represented by numerous species in the Mauritius, and here represented by 7 species; but it does not occur in India or on the mainland beyond the Andaman Sea. *Hyalimax* is another genus with a similar range. The physical features of this group of islands have been treated of by many authors, and their position, as regards the whole volcanic line of action, is now defined as one lying outside and to the west of it, and having its extension to the south-eastward in the Nias Islands off Sumatra.

Blanford and Medlicott, in the 'Manual of Geology of India,' vol. ii. p. 732, may be consulted; an interesting account by Mr. A. O. Hume and the other members of an expedition to the islands is given in 'Stray Feathers,' vol. ii. (1874). Still later Dr. Prain, in the 'Proceedings of the Asiatic Society of Bengal,' April 1892, and in the 'Journal' of the same Society, 1893, has given an account of his collections principally of the flora of Narcondam and Barren Island; although he mentions the presence of land-crabs, spiders, scorpions, and ants on Narcondam, no Mollusca are recorded.

All the above-mentioned air-breathers, it is quite possible, might reach this island on trees floated off from the Andamans during the monsoon which blows so long from that direction, and they would all have a better chance of survival in sea-water than Land-Mollusca, and might be carried for long distances inside the joints of the bamboos and large grasses.

Dr. Prain publishes two good maps of the Andaman Group, and the lines of soundings ranging from 100 to 2000 fathoms are shown. These point out very clearly, as he shows, that the Andaman Sea, as a physical feature, is distinct from the great oceanic depression outside, which he terms the sea of Bengal, down to about 5° north.

These contour-lines of soundings also show how the western face of the Andaman-Nicobar line of elevation suddenly descends into the deep water of about 10,500 feet in a distance of from 60 to 70 miles, and this is proportional nearly to the elevation of the Arakan range above the sea, on latitude 22°, near the head of the Bay of Bengal and to its distance from the present sea.

The parallel contour-lines of soundings down to the 1000-fathom line extend north up the coast of Arakan, and south close to the islands off the coast of Sumatra, Nias, &c., indicating a former extension of land upon this line.

It is said that the Andamans present evidence of recent subsidence[1], and these charts of Dr. Prain's show that an elevation of 600 feet in this single group would unite them to Pegu and Arakan, leaving an extremely narrow channel of only 50 fathoms deep south of Preparis. The Nicobars are more isolated, and deep wide channels separate them from the Andamans on one side and Sumatra on the other, which accords with the paucity of Land-Shells common to both, and the presence of a few found in Sumatra. That these islands have been cut off for a considerable period from the adjacent continents and islands is shown not only in the specific variation of the molluscan fauna, but equally in the birds by a great number of distinct and peculiar forms.

A great deal yet remains to be done: the highest parts of the Nicobars have never been collected on; here we may yet find species identical with those of the Andamans, for many obtained there come from the higher elevations, while most of those from the Nicobars have been taken near the sea-coast; and a few hundred feet of elevation would bring in quite a different set of forms.

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[1] S. Kurz, 'Report on the Vegetation of the Andaman Islands.'

II. *Table showing the Distribution of the Land-Mollusca of the Andaman and Nicobar Islands.*

North to South →

+ locality recorded.
— extension of a very closely-allied species.
⊙ species not examined by author.
○ species requiring examination.

Genus and Species.	ANDAMAN GROUP.							NICOBAR GROUP.										EXTENSION.				
	Preparis.	Cocos.	North Andaman.	Mid-Andaman.	South Andaman (Port Blair).	Brothers.	Little Andaman.	Car Nicobar.	Batte Maloe.	Teressa.	Camorta.	Katchal.	Nancowry.	Little Nicobar.	Great Nicobar.	Kondul.	Nicobars General.	Arakan and Burmah &c.	Bengal.	Madagascar.	Sumatra and Java.	Indian Peninsula.
1. Macrochlamys stephus, *Benson*	...	...	...	...	+																	
2. " exul, *Theobald*	...	...	...	...	+																	
3. " choinix, *Bs.*	...	...	...	...	+																	
4. " " var. gigantea, *Nev. MS.*	...	...	...	...	⊙																	
5. " perinconspicua, *Nev.*	...	...	...	...	...	+																
6. " woodmasoniana, *Nev. MS.*	...	⊙																				
7. " honesta, var. tenuior, *Nev. M.S.*	⊙	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	—				
8. " fordiana, *G.-A., Nev. MS.*	...	...	...	...	+																	
9. " aulopsis, *Bs.*	...	...	...	...	+																	
10. " pseudaulopsis, *G.-A., Nev. MS.*	...	...	...	...	+																	
1. Rotula massoni, *Behn*	...	...	...	...	...	..	...	+	...	...	...	+	+	...	...	...	+					
2. " " var. minor, *Mörch*	...	...	...	...	...	..	...	...	...	...	...	...	...	...	○	...	+					
3. " roepstorffi, *Mörch*	...	...	...	...	...	...	...	...	...	...	+	+	...	...	...	...	+					
4. " battemalvensis, *G.-A., Nev. MS.*	...	...	...	...	...	...	...	...	+													
5. " reinhardti, *Mörch*	...	...	...	...	...	..	...	...	...	...	...	...	...	...	⊙							
6. " frauenfeldi, *Zelebor, MS.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	+					
1. Macrochlamys? bathycharax, *Bs. MS.*	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	—				
2. " euomphalus, *Nev. MS.*	...	...	...	...	+	...	. .	...	...	...	...	...	...	...	...	...	...	—				
3. " subconvallata, *Nev. MS.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	—				
1. Microcystina rinki, *Mörch*	...	...	...	...	...	...	...	+	...	+	+	...	...	...	...	...	+					
2. " morchiana, *G.-A., Nev. MS.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	+					
3. " warnefordi, *Nev. MS.*	...	...	...	...	+	+																
4. " harrietensis, *G.-A., Nev. MS.*	...	...	...	...	+	...	...	...	...	...	+											
1. Liocystis? brunii, *Mörch*	...	...	...	...	...	...	...	...	...	...	...	...	...	⊙								
1. Microcystis camortensis, *Nev. MS.*	...	...	...	...	..	...	...	...	...	...	○											
2. " no. 154, *Nevill's Hand-list*	...	...	...	...	+																	
3. " no. 168, *Nevill's Hand-list*	...	...	...	...	...	○																
4. " no. 169	...	...	...	...	○																	
5. " subpatuloidea, *G.-A., Nev. MS.*	...	...	...	...	+																	

Table of Distribution (continued).

Genus and Species.	Preparis.	Cocos.	North Andaman.	Mid-Andaman.	South Andaman (Port Blair).	Brothers.	Little Andaman.	Car Nicobar.	Batte Maloe.	Teressa.	Camorta.	Katchal.	Nancowry.	Little Nicobar.	Great Nicobar.	Kondul.	Nicobars General.	Arakan and Burmah &c.	Bengal.	Madagascar.	Sumatra and Java.	Indian Peninsula.
	ANDAMAN GROUP.							NICOBAR GROUP.										EXTENSION.				
1. Sitala attegia, *Bs.*	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	+	+				
2. ,, haroldi, *G.-A.*	...	...	...	...	+	+	...	...	...	...	...	+	...	...	...	...	...	–				
3. ,, homfrayi, *G.-A.*, n. sp.	...	...	...	...	+																	
4. ,, subbilirata, *G.-A.*, *Nev. MS.*	...	...	...	...	...	+																
5. ,, ,, var., *G.-A.*, *Nev. MS.*	...	...	...	...	...	...	...	...	+													
6. ,, kjellerupi, *Mörch*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	⊙							
1. Discus sanis, *Bs.*	...	...	...	...	+																	
2. ,, pseudosanis, *Nev. MS.*	...	...	...	...	+																	
3. ,, andamanica, *Nev. MS.*	...	...	...	...	+																	
4. ,, sulcipes, *Mörch*	...	...	...	...	...	...	...	...	...	...	...	...	+	+	+							
,, ,, var. trilineata, *Mörch*	...	...	...	...	...	...	...	...	...	...	+											
5. ,, billiana, *Mörch*	...	...	...	...	...	...	...	...	...	...	...	+	+	+	+	...	+					
6. ,, iopharynx, *Mörch*	...	...	...	...	...	...	...	...	...	...	...	+										
7. ,, bicolor	...	...	...	...	...	...	...	...	...	+	...	+	...	...	...	...	+	...	...	...	+	
8. ,, ,, var.	+																					
9. ,, subnigritella, *Beddome*	...	...	...	...	+																	
1. Durgella christianæ, *Theob.*	...	...	...	...	+																	
2. ,, andamanicus, *Nev. MS.*	...	...	...	...	○																	
Girasia? (*see notes*).																						
1. Helix (Rhysota) conferta, *Pfr.*=haughtoni, *Bs.*	...	...	...	...	+																	
1. Planispira hemiopta, *Bs.*	...	...	...	...	+																	
,, ,, unifasciata, var., *Nev. MS.*	...	...	...	...	+																	
,, ,, albina, var., *Nev. MS.*	...	...	...	...	+																	
2. ,, trochalia, *Bs.*	...	...	...	...	+																	
,, ,, conico-elata, *Nev. MS.*	...	...	...	...	+																	
3. ,, helferi, *Bs.*	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	+					
4. ,, wimberleyi, n. sp.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+					
1. Sivella castra, *Bs.*	...	...	...	...	+																	
1. Trochomorphoides conulus, *v. Martens*	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...	...	...	+	

1. Janira ecdonodes, *Pfr.*, and its 3 varieties	...	...	...	...	...	...	...	+	...	...	+	...	..	...	+	+						
,, ,, edentula, *Mörch*																						
,, ,, minor, *Mörch*																						
,, ,, subcylindrica major, *Mörch*																						
,, ,, efasciata, *Nev. MS.*	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	+						
,, ,, subcarinata, *Nev. MS.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+						
,, ,, albolabris, *Nev. MS.*	...	...	...	...	...	...	...	...	...	...	..	...	...	...	+	+						
1. Stenogyra (Prosopeas) haughtoni, *Bs.*	...	...	...	...	+																	
2. ,, ,, roepstorffi, *Mörch*	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	+					
3. ,, ,, achates, *Mörch*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+					
4. ,, ,, sp ?, *Nev. MS.*	...	⊙																				
1. Opeas apex, *Mousson*, var. nicobarica, *Mörch*	...	...	...	...	...	...	...	...	...	+	...	...	+									
2. ,, gracilis, *Hutton*	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	+	+	...	+	
3. ,, achatinacea, *Pfr.*	...	...	...	...	...	...	...	...	...	...	+											
4. ,, ,, var., ? distinct, *Nevill*	...	+																				
5. ,, walkeri, *Benson*	...	+	...	...	+																	
6. ,, apex, larger var.	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...	...	+	
7. ,, ,, small var.	...	...	...	...	...	+																
1. Amphidromus andamanicus, *Thorpe*	...	+	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	—	
2. ,, ,, var. nicobarica, *Nev. MS.*	...	...	...	...	...	...	...	...	...	...	...	+										
1. Clausilia (Phaedusa) wüllerstorffi, *Zel.*	...	...	...	...	...	...	...	...	...	...	+	...	+									
2. ,, ,, corticina, *Busch*	...	...	...	...	...	...	...	...	...	...	...	...	..	...	+							
3. ,, ,, nevilliana, *Möll.*	...	...	...	...	...	...	...	...	...	...	+											
1. Ennea (Huttonella) bicolor, *Hutton*	...	...	...	...	+	...	...	...	...	...	...	..	+	...	...	...	+	+	+	+	+	+
2. ,, ,, moerchiana, *de Roep. MS., Nev.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+							
1. Streptaxis andamanicus, *Bs.*	...	+	...	...	+	...	...	...	...	...	...	..	...	...	...	...	...	—				
2. ,, blanfordi, var.	...	+	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+				
3. ,, pfeifferi, *Zelebor, MS.*	...	...	...	...	...	...	...	...	...	...	+	+										
,, ,, var. minor, *Mörch*	...	...	...	...	...	...	...	+														
,, ,, var. pumilio, *Mörch*	...	...	...	...	...	...	...	...	...	...	+											
1. Pupa (Pupisoma) constrictus, n. sp.	...	...	...	...	+																	
1. Hyalimax (Jarava) andamanica, *G.-A.*	...	...	...	...	+																	
2. ,, ,, ,, var. punctulatus, *Cockerell*, 1890	...	...	...	...	+																	
3. ,, ,, reinhardti, *Mörch*	...	...	...	...	...	...	...	...	...	...	+	...	...	...	+							
4. ,, ,, n. sp.?	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+					
1. Onchidium (Oncidiella) marmorata, *Lesson*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+					
2. ,, ,, steenstrupii, *Semper*	...	...	..	...	...	..	...	...	...	...	...	...	...	...	+							
3. ,, ,, mauritiana, *Blainville*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+							
4. ,, ,, sp. ?, *Nevill's Hand-list*	...	...	...	...	+																	
1. Vaginulus giganteus, n. sp.	...	...	...	...	+																	
1. Succinea ceylanica, *Pfr.*, var.	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	+

CYCLOPHORIDÆ.—*Andaman and Nicobar Islands.*

Genus and Species.	ANDAMAN GROUP.							NICOBAR GROUP.										EXTENSION.				
	Preparis.	Cocos.	North Andaman.	Mid-Andaman.	South Andaman (Port Blair).	Brothers.	Little Andaman.	Car Nicobar.	Batte Maloe.	Teressa.	Camorta.	Katchal.	Nancowry.	Little Nicobar.	Great Nicobar.	Kondul.	Nicobar General.	Arakan and Burmah.	Bengal.	Madagascar and Mascarene Is.	Sumatra and Java.	Indian Peninsula.
1. Cyclophorus (Cyclohelix) leai, *Tryon*	...	...	...	...	+																	
2. „ „ berkeleyanus, n. sp., *Nev. MS.*	...	+	...	...	+																	
3. „ „ foliaceus, *Chem.*	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	+					
4. „ „ crocatus, *Born*, = T. turbo, *Chem.*	...	...	...	...	...	...	...	...	...	...	+											
5. „ „ nicobaricus, *Behn*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	+						
6. „ moerchianus, *de Roep. MS.*	...	...	...	...	...	...	...	+	+													
7. „ perdix, var. roepstorffiana, *Nev. MS.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	+	...	...	...	+	
1. Leptopoma immaculatum, *Chem.*	...	...	...	...	...	...	...	...	...	...	+	+	...	...	...	...	+	...	...	...	+	
2. „ fragilis, *Sow., MS.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	+						
3. „ roepstorffianum, *Nev.*	...	...	...	...	+																	
4. „ „ var. albida, *Nev. MS.*	...	...	...	...	+	+																
5. „ „ var. gigantea	...	...	...	...	+																	
6. „ subperlucida, *Nev.*	...	+																				
1. Lagocheilus galatheæ, *Mörch*	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	+					
„ „ var. minor, *Mörch*	...	...	...	...	...	...	...	...	...	...	...	+										
2. „ wüllerstorffianus, *Zelebor*	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	+					
3. „ roepstorffi, *Mörch*	...	...	...	...	...	...	...	...	...	...	+	+	...	...	...	...	+					
4. „ „ var. cocoensis, *Nev. MS.*	...	+																				
5. „ warnefordianus, *Nev.*	...	...	...	...	+																	
6. „ polynema, *Mörch*	...	...	...	...	...	...	...	...	...	+												
7. „ „ var. no. 13, *Nev. MS.*	...	...	...	...	...	...	...	...	+													
8. „ tignarius, *Benson*	...	...	...	...	+																	
1. Acmella mellilla, n. sp.	...	...	...	...	+																	
2. „ moreletiana, *Nev.*	...	...	...	...	...	...	...	...	+													
3. „ roepstorffiana, *Nev.*	...	...	...	...	...	...	...	...	...	...	...	+										
4. „ andamanica, *Nev. MS.*	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	—				
5. „ gibboidea, *Nev. MS.*	...	...	...	...	○																	
1. Cyathopoma natalicium, n. sp.	...	...	...	...	...	...	...	...	...	...	+											
1. Diplommatina nicobarica, *G.-A.*	...	...	...	...	...	...	...	...	...	...	+	+										
2. „ battemalvensis, *Nev. MS.*	...	...	...	...	...	...	...	...	+													

1. Alycæus andamaniæ, *Benson*	...	...	...	...	+																	
2. " reinhardti, *Mörch*=nicobaricus	...	...	...	...	...	...	...	...	+	...	+											
" " var. minor, *Mörch*	...	...	...	...	...	...	...	...	...	...	+											
3. " busbyi, *G.-A.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+					
1. Omphalotropis conoidea, *Frauenfeld*	...	...	...	...	...	...	...	...	+	...	+	+	...	...	...	+						
2. " distermina, *Bs.*	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	...	...	−		
3. " andersoni, *W. T. Blf.*	...	+	...	...	+																	
4. " pallida, *W. T. Blf.*	...	...	...	...	+																	
5. " decussata, *W. T. Blf.*	...	...	...	...	+																	
6. " brevis, n. sp.	...	...	...	...	...	...	...	...	...	...	+											
7. " sordida, *Behn MS.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+							
1. Pupina nicobarica, *Pfr.*	...	...	...	...	...	...	...	...	...	...	+	+	...	...	+	+	...	−				
2. " " var. albina																						
3. " rana																						
4. " evertata, *Nev. MS.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+							
Raphaulus, young specimen, near *chrysalis*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	−				
Georissa pyxis, *Bs.*, var. roepstorffi, *Nev.*	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	+				
1. Truncatella valida, *Pfr.*	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...	...	+	...	...	+	...	+
" " var. minor, *Nev.*	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	+					
" " var. parcicostata, *Nev.*	...	...	...	...	+																	
" " var. candida, *Nev. MS.*	...	...	...	...	...	...	...	...	...	...	...	+										
1. Helicina dunkeri, *Zelebor*	+	...	...	...	...	...	...	...	...	...	+											
" " var. trilineata, *Mörch*	...	...	...	...	...	...	...	...	...	+												
2. " behniana, *Pfr.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	+						
" " var. pumilio, *Mörch*	...	...	...	...	...	...	...	...	...	...	...	+										
3. " nicobarica, *Philippi*	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	+				
" " var. hypozona, *Nev. MS.*	...	...	...	...	+																	
4. " zelebori, *Pfr.*	...	...	...	...	...	...	...	+	...	...	...	+	+									
" " var. battemalvensis, *Nev. MS.*	...	...	...	...	...	...	...	...	+													
5. " andamanica, *Benson*	...	+	...	...	+	...	...	...	...	...	...	...	...	...	...	+						
" " var. minor, *Nev.*	...	+																				
" " subvar. latezonata, *Nev. MS.*	...	...	...	...	+																	
" " " conico-elata, *Nev. MS.*	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	+						
" " " hypozona, *Nev. MS.*	...	...	...	...	+																	
" " " areorosa, *Nev. MS.*	...	...	...	...	+																	
" " " rubella *Nev. MS.*	...	...	...	...	+																	
" " " citrina, *Nev. MS.*	...	...	...	...	+																	
6. " scrupulum, *Benson*	...	...	...	...	+																	
" " subvar. lutea, *Nev. MS.*	...	...	...	...	+																	
" " " rubella, *Nev. MS.*	...	...	...	...	+																	
" " " luteo-zonata, *Nev. MS.*	...	...	...	...	+																	
" " " unizonata, *Nev. MS.*	...	...	...	...	+																	
" " " sub-concolor, *Nev. MS.*	...	...	...	...	+																	

III. *Notes and Descriptions of new Species.*

Genus MACROCHLAMYS.

1. MACROCHLAMYS ? STEPHUS, Bs. (p. 441).

This species has a small left shell-lobe, shaped as in *Cycloplax* (see fig. 4, pl. xxxi., Land and Freshwater Moll. Ind.). Jaw with prominent central projection.

It therefore does not, so far as the mantle is concerned, agree with typical *Macrochlamys*. Better spirit-specimens are required for examination.

4. MACROCHLAMYS CHOINIX, var. GIGANTEA (p. 441).

In a MS. copy of Nevill's 'Hand-list' *M. gigantea* is catalogued as a variety of *choinix*—"? a distinct species. Collected by F. A. de Roepstorff, Esq. Diam. 19·25; alt. 10·25 mm." I have not seen an example of this species.

6. MACROCHLAMYS WOODMASONIANA, Nevill MS. (p. 441).

This species is no. 33 of Nevill's 'Hand-list' (p. 23). The type is in the Indian Museum, Calcutta, obtained by Mr. J. Wood-Mason.

7. MACROCHLAMYS HONESTA, var. TENUIOR (p. 441).

This species is recorded in Nevill's 'Hand-list' (p. 24) as the Moulmein variety; and this is the typical locality, and collected there by Stoliczka and Theobald. It is also recorded from Preparis Island, the most northerly of the Andaman Group, from the collection of Ferd. Stoliczka. I have in my own collection three specimens given me by Stoliczka, undoubtedly a variety of *honesta*, but the locality marked on the label is "Nicobar?"; so I refrain from describing it at present.

8. MACROCHLAMYS FORDIANA, G.-A. (p. 441).

This species is no. 39 of Nevill's 'Hand-list'; it was unnamed when the catalogue was published. In his MS. catalogue Nevill has entered it as *fordiana* in ink, and *microsculpta* in pencil. Four specimens collected by Colonel Ford are the types in the Indian Museum; six specimens are recorded from Mr. de Roepstorff. I adopted the title *fordiana*, though I find *microsculpta* on labels in de Roepstorff's shells that have come to me. This species was described by me in the 'Annals and Magazine of Natural History' (ser. 6, ii. p. 57, 1888).

9. MACROCHLAMYS AULOPSIS (p. 441).

Nanina aulopsis, Bs.
Thalassia in Nomencl.

This is a true *Macrochlamys*. The right shell-lobe is well developed, the left was not well made out. The odontophore is similar to that of the above genus, the formula being 20—8—1—8—20 about.

Generative organs.—The male organ is long, and the amatorial organ is present.

The margin of the branchial sac from anal orifice is conspicuously mottled with black and white showing through the shell. It has a peculiar *capreolus*, or spermatophore, like *M. jainiana*, G.-A., from Parisnath, Land & Freshw. Moll. India, pl. xxviii. figs. 2 *b*, 2 *c*.

10. MACROCHLAMYS PSEUDAULOPSIS, G.-A., Nevill MS. (p. 441).

This is No. 108 of Nevill's 'Hand-list' (p. 32) and described by me (*l. c.*). This name occurs on labels in Mr. de Roepstorff's collection in Nevill's handwriting.

The jaw in this species is very much curved with strong central projection. It possesses the amatorial organ.

Genus ROTULA.

1. ROTULA MASSONI, Behn (p. 441).

Helix massoni, Behn, Pfr. Mon. Hel. iv. p. 344 (1859).

Rotula massoni, Semper, Reise, p. 40, pl. iii. f. 28, pl. vii. f. 17.

Nanina (*Rotularia*) *massoni*, Mörch, Journ. de Conch. sér. 3, xii. p. 308 (1872), et xvi. p. 354 (1876).

This shell was described from a single example.

The animal has a small right shell-lobe and one small left shell-lobe as in *Macrochlamys*. It is very pale in colour with black tentacles.

The odontophore is also as in *Macrochlamys*.

Jaw with a central projection.

20 to 25—12—1—12—20 to 25.

Semper on plate vii. gives the form of the teeth exactly; his specimen was from the Museum at Kiel, ex coll. 'Galathea.' The generative organs are also figured by Semper; it has no amatorial organ, and in this respect it coincides with *cœlatura* and *rufa*, both from Bourbon, the home of *detecta*, which Albers took as the type of his genus *Rotula*.

I am inclined to think that *R. roepstorffi* is only a synonym, the transverse sculpture on the apical whorls would disappear in old shells.

Genus MICROCYSTINA.

3. MICROCYSTINA WARNEFORDI, Nevill MS., G.-A. (p. 441).

This genus and species are described by me in the 'Land and Freshwater Mollusca of India' (p. 13, pl. iii. f. 8).

Jaw very curved, central projection well developed.

Genus MICROCYSTIS.

1. MICROCYSTIS CAMORTENSIS, Nevill MS. (p. 441).

A specimen of this species is in the Calcutta Museum, collected by de Roepstorff. I have not seen it; it is recorded in Nevill's MS. copy of the 'Hand-list.'

Genus SITALA.

2. SITALA HAROLDI, G.-A. Moll. Ind. p. 33, pl. x. figs. 7, 7*a* (p. 442).

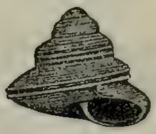
This species is no. 200 of Nevill's 'Hand-list' (p. 41); his *Microcystis stewartiana*, MS., but never described. Nevill gives its locality as Little Brother Andaman and Katchal, from de Roepstorff. No. 208 in the 'Hand-list' from Batte Malve, Nevill thinks is the same species.

3. SITALA HOMFRAYI, n. sp. (p. 442).

Locality. South Andaman (*de Roepstorff*).

Shell dextral, pyramidal, turreted, flat on base, imperforate; sculpture coarse transverse striation, with two ribs on the periphery and fine spiral close ribbing on the apical whorls; colour horny grey; spire conic; apex blunt and papillate; suture shallow; whorls $4\frac{1}{2}$, sides angulate, a strong raised rib on the periphery of the last whorl, and another similar rib above it at the angulation of the whorl, above the vertical portion; aperture ovately quadrate, very oblique; peristome thin, slightly thickened; columellar margin vertical.

Fig. A.



Sitala homfrayi. ×12.

Size: maj. diam. 1·4; alt. axis 1·4 mm.

This is a form allied to *Sitala subbiliratu* and *S. tricarinata*, and is of the same minute size as the latter, but it differs from it in the pyramidal form and smaller narrower aperture.

It occurred among a lot of small shells. I name it after Mr. Homfray, whose name is so well known as a first worker among the aboriginal inhabitants of these islands.

Genus DISCUS.

1. DISCUS SANIS (p. 442).

Nevill, in a MS. note, says "animal throughout of a jet-black colour."

3. DISCUS ANDAMANICA (p. 442).

Nevill describes this species as follows:—"The animal is quite different from that of *T. sanis*, being throughout whitish with grey tentacles. Shell more deeply solariformly umbilicate, bordered by an acute keel; spire more raised; whorls more closely wound; of lighter colour."

Genus Durgella.

2. Durgella andamanicus, Nevill MS. (p. 442).

I have not seen this species. It is entered in the 'Hand-list.' 10 in the Calcutta Museum (10 in spirit), type Andamans from de Roepstorff, "has been taken for the young of *Durgella christianæ*," which is not unlikely to be the case.

Genus Girasia.

Girasia, sp. inc. (p. 442).

My brother described having found, when he made the ascent of Saddle Peak on North Andaman with Col. Hobday of the G. T. Survey, a large slug-like form resembling this genus. It was done up in leaves, but was accidentally lost before they got into camp. This genus may therefore be sought for by future collectors.

Genus Planispira.

4. Planispira wimberleyi, n. sp. (p. 442).

Locality. Nicobars (*de Roepstorff*).

Shell depressedly orbiculate, narrowly umbilicated, very finely hirsute; sculpture, when this is abraded the surface is covered with minute regular papillation, which is much coarser than that of *H. helferi*; colour horny grey; spire rounded; apex rounded; suture impressed; whorls 4, not fully developed, slightly convex; aperture and peristome probably slightly expanded and reflected.

Size: maj. diam. 10·2, min. 8·9; alt. axis 5·7 mm.

This species is nearest to *H. helferi*, but may be distinguished by its narrower umbilicus and the great difference in sculpture, and the whorls above are not so flat. This is probably no. 102 of Nevill's 'Hand-list' (p. 76), collected by Ferd. Stoliczka.

Planispira helferi, Benson, has only hitherto been found in the Andamans; the young shell of four whorls and banded I found in Mr. de Roepstorff's collection from the Nicobars; but it might have got among them accidentally, and therefore this new habitat has to be confirmed.

Genus Sivella.

1. Sivella castra, Blandf.

A variety is recorded by Nevill, 'Hand-list,' p. 56, from the Andamans and a single specimen is in my collection from Mr. Wood-Mason.

The umbilicus is wider than in *castra* and the apex far flatter. Sculpture quite smooth below, with transverse striæ; whereas *castra* from typical locality, of same size, has close spiral striation most distinct. There is also a remarkable difference in the suture, the Andaman shell has a fine beading running into it, produced by the sharply defined carinate edge of the shell. I believe this to be only an immature *Discus sanis*.

I have lately, in a paper read at the Malacological Society, referred to the distinctness of this genus *Sivella*, constituted by W. T. Blanford for the Indian species *castra*, which he made the type. It differs in every respect from *Discus*, represented by *bicolor*, *sulcipes*, &c.; the anatomy of the latter I have been able to examine in specimens sent me by my brother from the Nicobars.

Genus TROCHOMORPHOIDES.

1. TROCHOMORPHOIDES CONULUS, Martens (p. 442).

Katchall (*de Roepstorff*).
Size: maj. diam. 11·2, min. 10·2; alt. axis 11·0 mm.

Genus AMPHIDROMUS.

2. AMPHIDROMUS ANDAMANICUS, var. NICOBARICA, Nev. MS., Hand-list, p. 127 (p. 443).

Of this species I have one specimen from Katchall. It is somewhat larger than Andaman shells, and in colour is far paler and with few markings, and those pale. These differences might not hold good in a large series.

Genus ENNEA.

2. ENNEA (HUTTONELLA) MOERCHIANA, De Roepstorff MS. Nevill, Hand-list MS. (p. 443).

This species comes nearest to *E. stenopylis* of the N.E. frontier.

Genus STREPTAXIS.

1. STREPTAXIS ANDAMANICUS, var. (p. 443).

This species comes near *S. blanfordi*, Theobald.
From Arakan and Pegu.

Genus PUPA.

1. PUPA (PUPISOMA) CONSTRICTUS, n. sp. (p. 443).

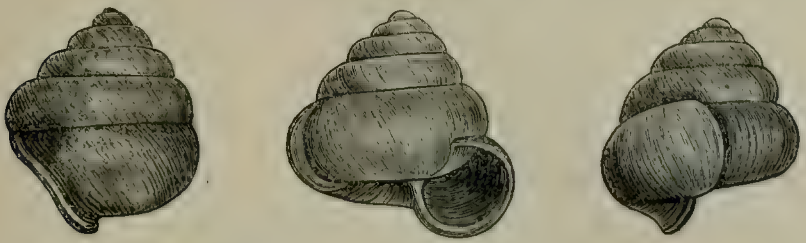
Locality. South Andaman (*de Roepstorff*).

Shell turbinate, perforate; sculpture minutely costulate above, from the swollen portion forwards the surface is smoother; colour, pale ochraceous; spire conic; sides flat; apex pointed; suture impressed; whorls 5, convex, at the distance of half a turn in the spiral behind the aperture there is a sharp swelling of the whorl, marking apparently the position of the previous aperture, but this is not seen in any of the whorls above; aperture ovate, oblique; peristome much thickened and reflected, united by a thin callus on the body-whorl; sinuate below and on outer margin.

Size: maj. diam. 2·1; alt. axis 2·2 mm.

Animal not yet seen, and it is difficult to say where this species should find generic position. I sorted out from a tube full of minute shells eight specimens of this very curious and interesting species.

Fig. B.



Pupa (Pupisoma) constrictus. ×12.

Its sculpture is like that of *Pupisoma lignicola*, Stol., from Moulmein, and I think it better to place it near this than to create a new genus for it, which I at first intended; I think it is best, however, to wait until some one else can examine the animal.

Genus VAGINULUS.

1. VAGINULUS GIGANTEUS, n. sp. (p. 443).

Locality. Andaman Islands (*Harold Godwin-Austen*).

Animal elongate in form. Total length 68·0 mm.; total breadth 23·0; breadth of foot 9·0; female orifice 28·5 from the extremity of the foot, 6·0 from the middle line of the foot, 1·5 from the pedal groove. The colour in the spirit-specimen is above grey, with dark mottlings, paler near the head, and a narrow pale line down the centre of the back; below dull ochre. Upper surface smooth to the eye, under the lens closely pitted. The sole of the foot narrow, slightly wider than the adjacent under surface. The foot is crossed by rather close, very regular folds, which form distinct grooves across it, very even in width; there are 22 such folds in 10 mm. of length, and each transverse fold is divided by a very fine secondary groove. The tentacles, although contracted, are large.

This is a remarkably large species, 13 mm. larger than anything described by Semper from the Indian region; the largest mentioned and figured by him is *V. voigtii*, described from a specimen in the Copenhagen Museum. Locality unknown. It differs from Semper's drawing of this species in being narrower as compared with its length, and in the sole of the foot. Semper's drawing is life-size, and could not fail to show the transverse ridges. As I have never yet dissected any species of this genus, I hesitate to begin upon a single valuable specimen until I have had some practice on well-known forms.

Genus CYCLOPHORUS.

5. CYCLOPHORUS (CYCLOHELIX) NICOBARICUS, Behn (p. 444).

This species is distinct from *C. crocatus* or *turbo*, and is at once distinguished by the very sinuate and oblique form of the columellar side of the aperture, which has almost a tooth on it. Nevill records it from Koudul and Galathea Bay (*Stoliczka*).

6. CYCLOPHORUS MOERCHIANUS, de Roepstorff MS. (p. 444).

Car Nicobar, June 1881.

This shell was in Mr. de Roepstorff's collection, with a label written by Nevill, saying, "This is my no. 64, p. 275 of Hand-list." I now consider it separable from *C. charpentieri*, and call it *C. moerchianus*, de R. MS. No. 64 of the 'Hand-list' is also found on Batte Malve (*F. Stoliczka*).

7. CYCLOPHORUS PERDIX, Broderip and Sowerby (p. 444).

No. 7. *Cyclophorus perdix*, var. *roepstorffiana*, Nevill MS., Hand-list.

"Alt. 15·5, diam. 21·5 mm. Distinguished from *C. zollingeri*, Mousson, by the less dilated last whorl and smaller aperture, keel more developed, and coloration of base different. Great Nicobar (type var. coll. F. A. de Roepstorff)."

To *C. perdix* Von Martens (Moll. Ost-Asien, p. 136) joins *C. zollingeri* (Sunda Strait and Banka) and *C. porphyreticus*, Benson, from Penang. I find one young shell of this species among Mr. de Roepstorff's shells, and I have three others, also immature, sent to me by my brother from the Nicobars.

Genus LEPTOPOMA.

1. LEPTOPOMA IMMACULATUM, Chemn. (p. 444).

Nevill, in his MS. Hand-list, writes: "The *L. vitreum*, Lesson, is scarcely separable from *L. immaculatum*, especially var. *latilabre*, Mart. (Ceram), of the former, which Pfeiffer indeed considered a form of the latter. Mörch has correctly identified the type of Chemnitz's species as the Nicobar form. The Philippine form is certainly distinct; it must take the name of *L. læve*, as it is undoubtedly the form so-called by Wood and Reeve."

3. LEPTOPOMA ROEPSTORFFIANUM (Nev.) (p. 444).

This species is described in Nevill's 'Hand-list.' Var. *gigantea*, from the Andamans, and var. *albida* are given in his MS. copy.

1. LAGOCHEILUS WÜLLERSTORFIANUS, Pfeiffer and Zelebor (p. 444).

The operculum in this species is very thin, horny, slightly concave, and multispiral, flat in front.

In young specimens the surface is very rough, the spiral rib on the periphery finely hirsute, and the fine transverse striation in high relief; in this state the flame-like bands of colour are not visible, they are only seen in the weathered shells.

3. LAGOCHEILUS ROEPSTORFFI, Mörch (p. 444).

Under this head Nevill, in his MS. Catalogue, gives var. *cocoensis*, from the Great Coco Island, collected by Ferd. Stoliczka.

The type is in the Indian Museum, Calcutta, so I have not seen it. Nevill gives *polynema*, Mörch, from Teressa, collected by de Roepstorff, which is no. 10 of the 'Hand-list,' and no. 13 from Batte Malve, collected by Stoliczka, as a variety of *polynema*.

Genus LAGOCHEILUS.

8. LAGOCHEILUS TIGNARIUS, Bs. (*Cyathopoma*?, Benson) (p. 444).

The operculum in this species is slightly concave in front, multispiral; the spiral defined by a narrow rib in relief. The operculum of *L. tomotrema*, of the Khási Hill ranges, is horny, quite smooth in front, the spiral formation being but scarcely apparent.

ACMELLA.

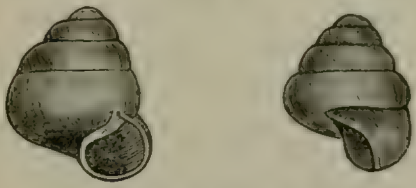
Under this genus Nevill records *A. andamanica* as being in the Calcutta Museum, and says: "compared with *A. hyalina* (Theob. and Stolicz. from Moulmein), of which it is probably a large variety."

1. ACMELLA MELLILLA (p. 444).

Locality. South Andaman (*de Roepstorff*).

Shell dextral, ovately turreted; sculpture oblique, fine, close costulation; colour pale umber; spire depressedly conic; apex very blunt, suture impressed; whorls 5, sides flat; aperture oval, suboblique; peristome double, with a strong callus on the body-whorl.

Fig. C.



Acmella mellilla.

Size: maj. diam. 1·25; alt. axis 1·75 mm.

Only one specimen in the collection.

5. ACMELLA GIBBOIDEA, Nevill MS. (p. 444).

The two typical examples of this species are in the Indian Museum, collected by de Roepstorff in the Andamans.

Genus CYATHOPOMA.

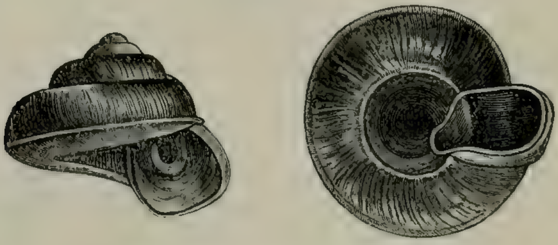
1. CYATHOPOMA NATALICIUM, n. sp. (p. 444).

Locality. Camorta.

This is no. 50 of Nevill's 'Hand-list,' which is not named. There are four specimens in the Indian Museum.

Shell dextral, depressedly turbinate; openly umbilicated, flat below, angulate at the umbilicus; sculpture smooth above, with very fine regular transverse costulation on the last whorl, with a strong lirate rib on the periphery; colour pale ochraceous; spire low; apex blunt; suture well marked; whorls 4½, convex; aperture arcuately circular, subvertical, sinuate on outer margin, somewhat angular below at the peripheral ribs; peristome double-continuous.

Fig. D.



Cyathopoma natalicium. ×12.

Size: maj. diam. 2·25; alt. axis 1·2 mm.

Operculum multispiral, elongate, with a deep central depression. This appears, from the number of specimens in the tube, to be an abundant species. It is a very pretty distinct form.

Genus Diplommatina.

1. Diplommatina nicobarica, G.-A. Land and Freshwater Moll. Ind. p. 185, pl. xlvi. figs. 7, 7 *a* (p. 444).

This species is no. 13 of Mr. G. Nevill's Hand-list (p. 284)= *roepstorffiana*, Nevill MS., from Katchall (*de R.*).

This species in Mr. de Roepstorff's collection bears the name of *D. carneola*, Stol.=*battimalyensis*, Nevill. In the amended 'Hand-list' I find the title *roepstorffiana* entered and the typical locality Katchall, with 3 specimens from Camorta and 20 from Batte Malve, collected by F. Stoliczka. It is somewhat similar to *D. carneola* from Moulmein, but it is more elongate and the costulation far closer and finer.

2. Diplommatina nicobarica, var. battemalvensis, n. sp., Nevill MS. (p. 444).

I have discovered among some shells put up by Mr. G. Nevill two specimens in a tube, labelled as above, from the island of Batte Malve; they agree in all characters with the last species, but are much larger and more tumid, the antepenultimate whorl being much larger than in *nicobarica*.

Size: maj. diam. 1·3; alt. axis 3·0; body-whorl 0·9 mm.

Genus ALYCÆUS.

2. ALYCÆUS REINHARDTI, Mörch (p. 445).

The type of this species is from Great Nicobar Island and is larger than the species from Camorta, named by Mörch var. *minor*, only averaging 4 mm. in diameter. The latter differs also in the form of the aperture, which is more circular and simple, the external peristome not being expanded and inflected, particularly below.

The form from Katchall is nearly as large and like that from the Great Nicobar.

3. ALYCÆUS BUSBYI, G.-A. (p. 445).

This species was described in the Society's 'Proceedings' for 1893, p. 595.

Genus OMPHALOTROPIS.

6. OMPHALOTROPIS (REALIA) BREVIS, n. sp. (p. 445).

Locality. Camorta, Nicobars (*de Roepstorff*).

Shell dextral, elongately turbinate, rimate; sculpture smooth, covered with a fine epidermis, having a few indistinct lines of growth; colour pale yellowish horny; spire conical, sides flat; apex sharp; suture impressed; whorls 6, the last slightly carinate with a hair-like keel, which is seen in the whorl above; below a hair-like keel round the umbilical region; aperture ovate; peristome thin, not complete in specimen.

Size: maj. diam. 1·8; alt. axis 2·8 mm.

Animal. One specimen was in a tube with a label by Nevill: "beats me, please send others." Camorta. In sorting out tubes full of mixed species I found two others inside two examples of *Microcystina*.

It is so much smaller than any species of this genus from these islands, although not quite adult, that I have no hesitation in naming it.

Genus PUPINA.

1. PUPINA NICOBARICA (p. 445).

Under this name Nevill gives two varieties in his MS. Catalogue: var. *nana*, long. 4·6, alt. 2·5 mm., Great Nicobar, and var. *evertata*, from de Roepstorff, from the same island.

As I have pointed out in the 'Land and Freshwater Mollusca of India,' p. 45 (1882), the genus *Sagdinena* of Mörch will not stand; his *S. didrichsenii* turns out to be an operculated form. There are some 20 specimens in Mr. de Roepstorff's collection, in seven of which I detected the operculum. This is multispiral, of about 4 whorls, and very thin; further examination showed that the shells were young *Pupinæ*; the operculum also corresponded. In some shells of *Pupina nicobarica* and in the white variety *albina* distinct transverse fine ribbing is seen, and on breaking a mature shell back to the same number of whorls as in so-called *Sagdinella* a precisely similar form of shell was presented. Moreover, this *Pupina*, at the commencement of the fifth whorl, contracts very considerably and the shell is perforate at this stage. On turning to the original description I see that Professor Mörch described it from a single example, and I can quite understand his being misled by this peculiar young form, so very unlike the typical mature shell in *Pupina*. I note that in this white very thin variety every gradation can be seen from shells quite glassy to others most distinctly ribbed. The drawing of *Sagdinella didrichseni* given on plate ix. figs. 1, 1 *a*, in my 'Land and Freshwater Mollusca of India,' was made from the type specimen sent to me from the Copenhagen Museum.

HELICINA.

Nevill gives many varieties and subvarieties of the species of this genus, particularly of *H. andamanica* and *H. scrupulum*; he records that the animal of *H. andamanica* from Mount Harriet, Port Blair, "is of a mottled dark grey colour, sparsely dotted with sand-like specks, base of the tentacles yellow."

List of Genera and number of Species.

HELICACEA.

Genus.	Common.	Andaman.	Nicobar.	Total.
Macrochlamys	...	10	...	10
Rotula	...	...	6	6
Macrochlamys?	...	2	1	3
Microcystina	1	2	3	4
Liocystis	...	...	1	1
Microcystis	...	4	1	5
Sitala	2	4	3	5
Discus	...	5	6	10
Durgella	...	2	...	2
Rhysota	...	1	...	1
Planispira	1	6	2	7
Trochomorphoides	...	...	1	1
Janira and 6 varieties	...	...	1	1
Stenogyra—Prosopeas	...	2	2	4
„ —Opeas	...	4	3	7
Amphidromus	...	1	1	2
Clausilia	...	...	3	3
Ennea	1	1	2	2
Streptaxis	...	2	1	3
Pupisoma	...	1	...	1
Hyalimax	...	2	2	4
Onchidium	...	1	3	4
Vaginulus	...	1	...	1
Succinea	...	...	1	1
	5	51	43	88

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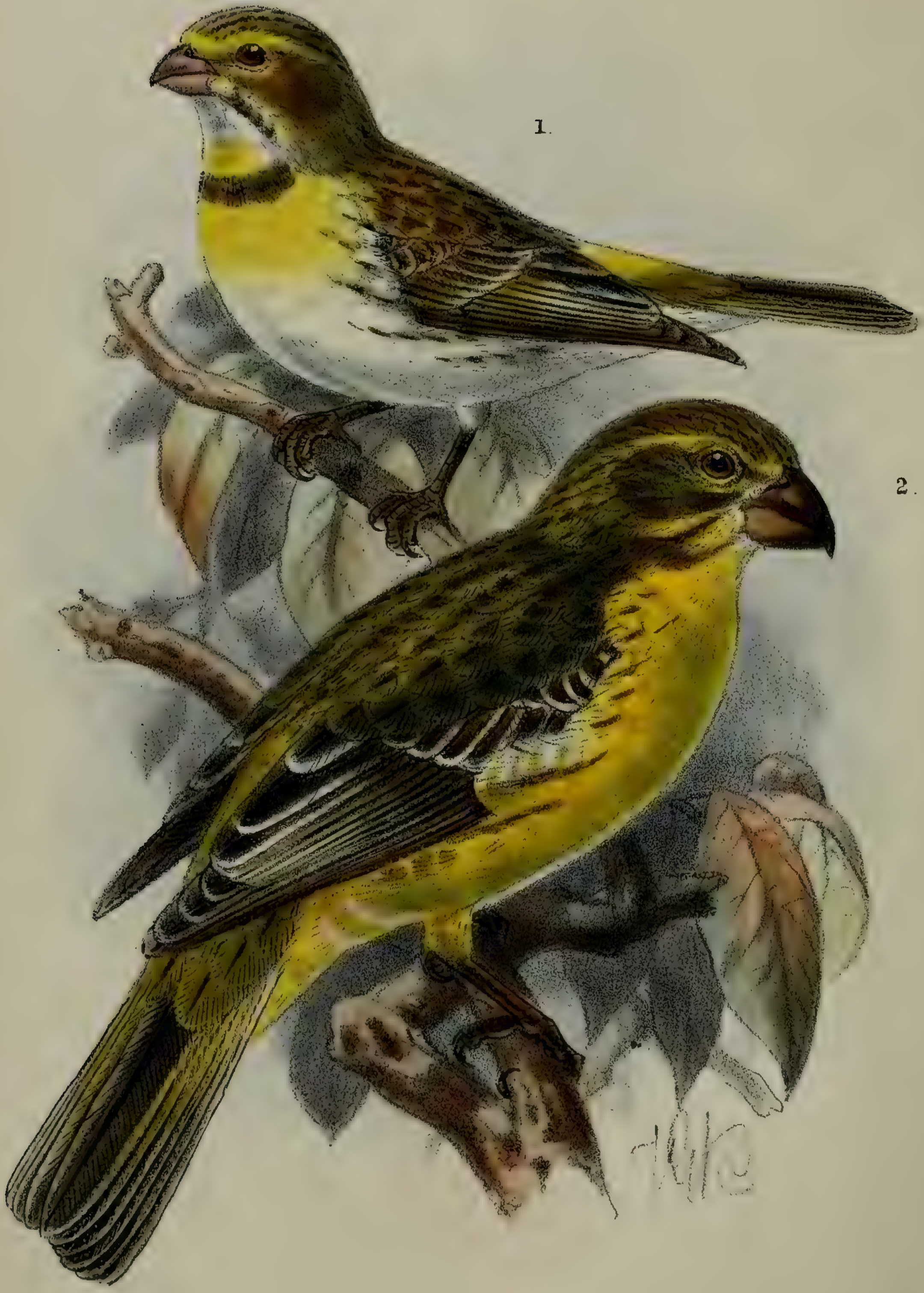

J. G. Keulemans del. et lith.

Mintern Bros. imp.

1. SERINUS MACULICOLLIS.
2. „ DONALDSONI.

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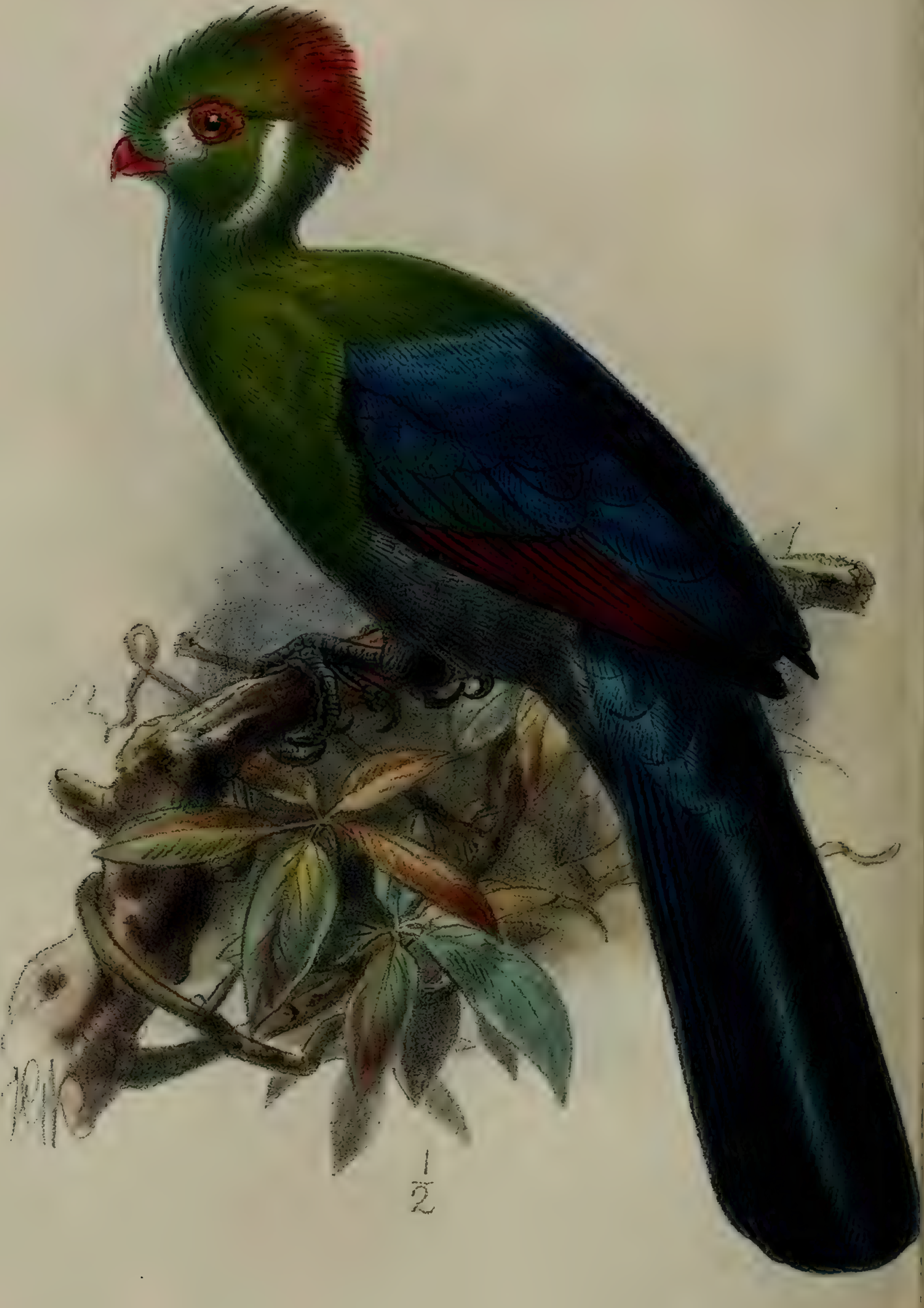

J. G. Keulemans del. et lith.

Mintern Bros. imp.

TURACUS DONALDSONI

CYCLOPHORIDÆ.

Genus.	Common.	Andaman.	Nicobar.	Total.
Cyclophorus (Cyclohelix)	...	2	5	7
Leptopoma	...	4	2	6
Lagocheilus	...	3	5	8
Acmella	...	3	2	5
Cyathopoma	...	...	1	1
Diplommatina	...	...	2	2
Alycæus	...	1	2	3
Omphalotropis	...	4	3	7
Raphaulus	...	...	1	1
Pupina	...	...	1	1
Georissa	...	1	...	1
Helicina	2	4	4	6
Truncatella	1	1	1	1
	3	23	29	49
Helicacea brought forward	5	51	43	88
Total	8	74	72	137

7. On a Collection of Birds made by Dr. A. Donaldson Smith during his recent Expedition in Western Somali-land. By R. BOWDLER SHARPE, LL.D., F.L.S., &c.

[Received June 24, 1895.]

(Plates XXVII. & XXVIII.)

The collection made by Dr. Donaldson Smith has proved to be of great importance, and some of his discoveries have been extremely interesting. The country through which he passed after leaving the Shebeli River has never been explored by a naturalist, and the result of Dr. Donaldson Smith's expedition has been to make us acquainted with quite a number of new species. The route taken has been described by the explorer in the 'Geographical Journal' for February of the present year (pp. 124–127), where a map of the country is given.

Starting from the Shebeli River, Dr. Smith marched in a north-westerly direction over gradually rising ground, till he reached an elevation of more than 5000 feet, and at Gineh, where he stayed for some time, the height is 6920 feet. In this neighbourhood and on the Darro Mountains (8000 feet) he obtained several of his most interesting birds, as also in the vicinity of Sheik Husein and Sheik Mahomed.

This exploration of Dr. Donaldson Smith's enables us to make a comparison of the avifauna of Western Somali-land with that of Abyssinia and Shoa and with that of the more southern regions of the Lake Country, and also of East Africa. I have therefore given references to Von Heuglin's work on the birds of North-eastern Africa, as well as to the following papers on the birds of Somali-land:—

G. E. SHELLEY.—"On Mr. E. Lort Phillips's collection of Birds from Somali Land." Ibis, 1885, pp. 389–418, pls. x.–xii.

E. OUSTALET.—"Catalogue des Oiseaux rapportés par M. G. Révoil de son deuxième Voyage aux pays des Çomalis (Afrique Orientale)." Bibl. de l'École des Hautes Études, xxxi. art. no. 10, pp. 1–14 (1886).

T. SALVADORI.—"Uccelli del Somali raccolti da D. Eugenio dei Principe Ruspoli." Mem. R. Accad. Torino, (2) xliv. pp. 547–564.

I have also referred to the excellent papers by Count Salvadori on the birds of Shoa, and to the recently published 'Vögel Deutsch-Ost-Afrika's' of Dr. Reichenow.

For the sake of convenience, I have followed the order adopted in my papers on the collections made by Mr. F. J. Jackson (Ibis, 1891, pp. 233–260, 587–602; 1892, pp. 152–164, 229–322, 534–555), so as to render a comparison possible between the avifaunæ of the two districts. The present collection being the largest that has ever been made in Somali-land, I have taken the opportunity of giving in full the distribution of the species as stated by Heuglin, Salvadori, and Reichenow, so that we can now draw some conclusions as to the relations of the avifauna of Somali-land with that of the surrounding countries, which it has not been possible to do before.

The localities of the specimens are mostly to be found in Dr. Smith's map; but for the identification of those not mentioned there I have been indebted to the kindness of Mr. F. Gillett, who accompanied Dr. Smith on his expedition, but who had to return to England from the Shebeli on receipt of the news of his father's death. He brought the collections made up to the date of the return of the expedition to the Webi-Shebeli safely to the coast, and he has given me the names of the different camping-places.

Order PASSERES.

Fam. CORVIDÆ.

1. CORVULTUR CRASSIROSTRIS.

Archicorax crassirostris (Rüpp.); Heugl. Orn. N.O.-Afr. i. p. 507.

Corvultur crassirostris (Rüpp.); Sharpe, Cat. B. iii. p. 25 (1877); Salvad. Ann. Genov. (2) i. p. 205 (1884), vi. p. 302 (1886).

a, *b*. ♂ ♀ ad. Sheik Husein, Sept. 22, 1894.

This large Raven is said by Heuglin to be an inhabitant of the mountains of Abyssinia, above 4000 feet, northwards to Hamasien, and eastwards to Qalabat and Takah, south to Shoa and the Somali plateaux, and thence, in the elevated districts, westwards from the Upper White Nile. Antinori found the species common in the mountains of Ankober in Shoa. In East Africa it is replaced by *C. albicollis* (*cf.* Reichen. Vög. Deutsch-Ost-Afr. p. 166).

Fam. STURNIDÆ.

2. DILOPHUS CARUNCULATUS.

Dilophus carunculatus (Gm.); Heugl. Orn. N.O.-Afr. i. p. 529; Salvad. Ann. Mus. Genov. (2) i. p. 197 (1884), vi. p. 297 (1888); Sharpe, Cat. B. xiii. p. 61 (1890); id. Ibis, 1891, p. 243; Salvad. Mem. R. Accad. Torino, (2) xliv. p. 560 (1894); Reichen. Vög. Deutsch-Ost-Afr. p. 171 (1894).

a. ♀. Hargeisa, July 16, 1894. Iris brown; bare skin lemon-yellow.

Heuglin was not certain whether this Starling is sedentary in N.E. Africa or not. It was rare, and found during the rainy season in Abyssinia, on the Blue and White Niles, and in Kordofan. In Shoa, however, Antinori found it in flocks throughout the year in the valley of Daimbi, breeding in May. Ragazzi records it from the Falls of Gherbá. Mr. Jackson met with the species in Kitosh, and says that it was very common all round Naivasha and north to Kisidong in large flocks. It is also distributed widely in German East Africa, Dr. Reichenow giving the following localities for the species:—Igónda, Ugálla, Irángi, Wembaere Steppes, Simiu River, Ampeke, Ikuni Island.

Family EULABETIDÆ.

3. LAMPROTORNIS PORPHYROPTERUS.

Lamprotornis purpuroptera, Rüpp. Syst. Uebers. pp. 64, 75, Taf. xxv. (1845); Salvad. Ann. Mus. Genov. (2) i. p. 198 (1884).

Lamprotornis porphyroptera (Cab.), Heugl. Orn. N.O.-Afr. i. p. 511; Sharpe, Cat. B. Brit. Mus. xiii. p. 156 (1890); id. Ibis, 1891, p. 240; Reichen. Vög. Deutsch-Ost-Afr. p. 173 (1894).

a. ♂. Sheik Husein, Oct. 1, 1894. Iris cream-colour.

According to Heuglin a tolerably common bird in the mountains of Northern Abyssinia up to 6000 feet and the western "Quola" district, in Senar, Kordofan, Takah, and along the White Nile and its tributaries. It is sedentary, breeding in July and August. In Shoa, Antinori says it is plentiful in the "Kolla" districts, but was rare near Daimbi. Mr. Jackson found the species plentiful in small flocks in Turquel; and, according to Dr. Reichenow, it is found on the Pangani and Ugálla Rivers, and his other localities are Bukomé Itále, Kagéyi, and the Simiu River, while it has likewise been found at Witu, Lamo, and in Wapokomoland, and at Nassa on the Victoria Nyanza.

4. COSMOPSARUS REGIUS.

Cosmopsarus regius, Shelley, Ibis, 1885, p. 411; Sharpe, Cat. B. Brit. Mus. xiii. p. 160 (1890); id. Ibis, 1891, p. 241 Salvad, Mem. R. Accad. Torino, (2) xliv. p. 559 (1894: Webbe River, Webbe Schebeli, Hento Valley, Banan); Reichen. Vög. Deutsch-Ost-Afr. p. 173 (1894).

a. ♂ ad. Milmil, July 26, 1894.
b. ♂ ad. Hargeisa, July 21, 1894. Iris white.
c. ♂ ad. Jadid-hurrieh, Jan. 7, 1895. Iris white.

Somali-land seems to be the metropolis of this beautiful species: but it has been found to the south at Pare by Dr. Fischer, and in the "wilderness" near the River Tsavo (not "Tskro," as printed in my paper!) by Mr. Jackson. Here it was plentiful.

5. GALEOPSAR SALVADORII.

Galeopsar salvadorii, Sharpe, Ibis, 1891, p. 241, pl. iv.

a, b. ♂ ♀. Stonybrook, Ehrer River, August 18, 1894.

There appears to be no difference in the colouring of the sexes.

This species was discovered by Mr. F. J. Jackson in Turquel, and Dr. Smith found it in the mountainous country on the Ehrer River, near its junction with the Shebeli. I have also received a specimen from Mr. Neumann obtained between Mt. Kenia and Lake Rudolph.

6. AMYDRUS MORIO.

Amydrus morio (L.); Sharpe, Cat. B. Brit. Mus. xiii. p. 161 (1890); id. Ibis, 1891, p. 242; Reichen. Vög. Deutsch-Ost-Afr. p. 172 (1894).

Amydrus rueppelli, Verr.; Heugl. Orn. N.O.-Afr. i. p. 524; Salvad. Ann. Mus. Genov. (2) i. p. 201 (1884), vi. p. 299 (1888).

a. ♀. Sheik Mahomed, Nov. 13, 1894. Iris bright red; bill and feet black.

In N.E. Africa, Heuglin considered this species not to be sedentary. He found it in rocky valleys with high trees in Abyssinia, northwards to Barka, in Fazogl, and Southern Kordofan, but only during the rainy season. In Shoa, Antinori states that the speciesis common on the elevated "Kolla" at a moderate height. Mr. Jackson met with it on Mount Elgon, at Turquel, and also in the Ulu country in Ukambani. Dr. Reichenow records the species from Ugógo, Nguru, Kilima-njaro, Lake Tanganyika, and Bussisi.

7. LAMPROCOLIUS CHALYBEUS.

Lamprocolius chalybeus (Ehr.); Heugl. Orn. N.O.-Afr. i. p. 514; Salvad. Ann. Mus. Genov. (2) i. p. 199 (1884), vi. p. 297 (1888); Sharpe, Cat. B. Brit. Mus. xiii. p. 176 (1890); id. Ibis, 1891, p. 242; Salvad. Mem. R. Accad. Torino, (2) xliv. p. 559 (1894: Hento Valley).

a. ♂. Dabulli, Sept. 16, 1894. Iris orange.
b. ♀. Goura, Sept. 14, 1894. Iris golden yellow.

One of the commonest and most widely distributed birds in N.E. Africa. In the Nile district and the Bischarin Steppes it extends northwards to 20° N. lat. It reaches also the coast of Samhar, and is found over the whole of Abyssinia up to 8000 or 9000 feet, in the Gala countries, in Senaar and Kordofan, as well as in the district of the Lower Nile. In Shoa, Antinori found the species breeding. Mr. Jackson met with it near Lake Naiwascha, but in East Africa generally its place seems to be taken by *L. sycobius*, Peters (*cf.* Reichen. Vög. Deutsch-Ost-Afr. p. 172).

8. HETEROPSAR ALBICAPILLUS.

Notauges albicapillus (Blyth); Heugl. Orn. N.O.-Afr. i. p. 520 (1871); Shelley, Ibis, 1885, p. 413; Oust. Bibl. École Hautes Études, xxxi. art. 10, p. 11 (1886).

Heteropsar albicapillus, Sharpe, Cat. B. Brit. Mus. xxxi. p. 186 (1890); Salvad. t. c. p. 559 (1894: Warandab).

a. Ad. Lessabane, 3150 feet. Breeding.

9. SPREO SHELLEYI.

Spreo shelleyi, Sharpe, Cat. B. Brit. Mus. xiii. p. 190 (1890).

a. ♂. Hargeisa, July 21, 1894. Iris orange.

b. ♀. Darar, Sept. 15, 1894. Iris orange next the pupil, merging into lemon-yellow.

10. SPREO SUPERBUS.

Notauges superbus (Rüpp.); Heugl. Orn. N.O.-Afr. i. p. 517 (1871); Shelley, Ibis, 1885, p. 412; Oust. Bibl. École Hautes Études, xxxi. art. 10, p. 11 (1886); Salvad. Ann. Mus. Genov. (2) i. p. 199 (1884), vi. p. 298 (1888); id. Mem. R. Accad. Torino, (2) xliv. p. 560 (1894: Warandab and Mandera).

Spreo superbus, Sharpe, Cat. B. Brit. Mus. xiii. p. 189 (1890); id. Ibis, 1891, p. 243; Reichen. Vög. Deutsch-Ost-Afr. p. 171 (1894).

a. ♂ ad. Dunarn, Jan. 4, 1895. Iris cream-colour.

Heuglin states that this Starling is found on the Somali plateaux, on the highlands of Shoa, on the Bahr-el-Abiad, and the upper Djur. On the White Nile it never extends north of 7° or 8° N. lat. Brehm's statement that the species is found up to 10° N. lat. is wrong, according to Heuglin, who says that it is met with first to the *south* of the swamp-region. Ragazzi met with it in Shoa at Cialalakà, and Antinori says that it is very common in the spacious valley of Daimbi, where it is resident. Mr. Jackson met with it at Machako's in Ukambani, and Dr. Reichenow gives many localities in German East-Africa, from Dar-es-Salaam through Masai-land.

Fam. BUPHAGIDÆ.

11. BUPHAGA ERYTHRORHYNCHA.

Buphaga erythrorhyncha (Stanl.); Heugl. Orn. N.O.-Afr. i. p. 716 (1891); Shelley, Ibis, 1885, p. 410; Salvad. Ann. Mus.

Genov. (2) i. p. 196 (1884), vi. p. 297 (1888); Sharpe, Cat. B. Brit. Mus. xiii. p. 196 (1890); id. Ibis, 1891, p. 243; Salvad. Mem. R. Accad. Torino, (2) xliv. p. 561 (1894: Warandab); Reichen. Vög. Deutsch-Ost-Afr. p. 170 (1894).

a, b. ♀. Widdarwiddo, Dec. 4, 1894. Iris orange; bill vermilion; eyelids bright yellow.

In North-eastern Africa, according to Heuglin, this species is commoner than *B. africana*. It is found in the coast-districts of Abyssinia down to Somali-land, in the low-lying hot districts of Abyssinia up to 6000 feet, further west on the Upper Blue and White Niles, and apparently also in the mountains to the south of Kordofan. In Shoa it is common, according to Antinori, and Ragazzi also records it as very plentiful. Dr. Reichenow gives a very general distribution for the species in East Africa—Usegúha, Ugógo, Aruscha, Sigirari, Ugálla, Kakoma, Kawendi. Mr. Jackson also procured it in Ukambani, and again in Kitosh.

Fam. DICRURIDÆ.

12. BUCHANGA ASSIMILIS.

Dicrourus divaricatus (Licht.); Heugl. Orn. N.O.-Afr. i. p. 422 (1871).

Buchanga assimilis (Bechst.); Sharpe, Cat. B. Brit. Mus. iii. p. 247 (1877); Shelley, Ibis, 1885, p. 410; Salvad. Mem. R. Accad. Torino, (2) xliv. p. 555 (1894).

Dicrurus afer (Licht.); Reichen. Vög. Deutsch-Ost-Afr. p. 166 (1894).

Musicus assimilis, Salvad. Orn. Mus. Genov. (2) i. p. 113 (1884), vi. p. 239 (1888).

a. ♀ ad. Sibbe, Aug. 3, 1894. Iris red.

This species is found commonly, both singly and in pairs, in North-eastern Africa, but only south of the line of rainfall (20° N. lat.), the hot coast-lands of Abyssinia to the districts of the Danakil and Somali people, up to the heights of the Abyssinian mountains, in Senar, Takah, Southern Nubia, Kordofan, and the White Nile districts, according to Heuglin. It has a wide distribution throughout Eastern Africa. In Shoa, Antinori says it is a common species in the mimosa bushes, in the low "Kolla," and on the plains, as well as along the rivers and marsh-lands.

Fam. ORIOLIDÆ.

13. ORIOLUS LARVATUS.

Oriolus larvatus, Licht.; Heugl. Orn. N.O.-Afr. i. p. 403 (1869); Sharpe, Cat. B. Brit. Mus. iii. p. 217 (1877); id. Ibis, 1891, p. 243.

Oriolus rolleti, Reichen. Vög. Deutsch-Ost-Afr. p. 168 (1894).

a. ♂ ad. Darar, Sept. 15, 1894. Bill light brown; feet grey; iris carmine.

In Shoa the place of this species is taken by *Oriolus monachus*. *O. rolleti* is a small race, which does not seem to me to be specifically distinct from *O. larvatus*; but it is this form which occurs in Somali-land, and is recorded by Dr. Reichenow from numerous localities throughout Eastern Africa. Mr. Jackson met with the species at Turquel in the Suk country and on Mount Elgon.

O. rolleti is said by Heuglin to be found on the Upper White Nile. On the Belenia Mountains it is not rare, but does not extend north of 8° N. lat.

Fam. PLOCEIDÆ.

14. VIDUA PRINCIPALIS.

Vidua principalis, Heugl., Orn. N.O.-Afr. i. p. 585 (1871); Oust. Bibl. École Hautes Études, xxxi. art. 10, p. 10 (1886); Sharpe, Cat. B. Brit. Mus. xiii. p. 203 (1890); id. Ibis, 1891, p. 244.

Vidua erythrorhyncha (Sw.); Salvad. Ann. Mus. Genov. (2) i. p. 181 (1884), vi. p. 285 (1888).

Vidua serena (L.); Reichen. Vög. Deutsch-Ost-Afr. p. 193 (1894).

a. ♂ hiem. Sheik Husein, Oct. 30, 1894. Iris dark brown; bill vermilion.

Heuglin was not certain whether this little Weaver-bird was resident in North-eastern Africa. Its northern limit seems to be between 16° and 17° N. lat., and from here it occurs southwards on the coast and in the interior of Abyssinia, but not beyond 6000–7000 feet in Takah, Senar, Kordofan, and the region of the White Nile. In Shoa, Antinori says that the species arrives in May and remains till September. Dr. Ragazzi met with individuals in March, May, and June. Mr. Jackson only obtained the species at Nzoni in February, but it is very widely spread over East Africa, from the coast up to the Victoria Nyanza.

15. LINURA FISCHERI.

Linura fischeri, Reichen.; Salvad. Ann. Mus. Gen. (2) vi. p. 104 (1888); id. Mem. R. Accad. Torino, (2) xliv. p. 557 (1894: S. of desert of Ogaden); Reichen. Vög. Deutsch-Ost-Afr. p. 192 (1894); Sharpe, Cat. B. Brit. Mus. xiii. p. 210 (1890).

Vidua (Linura) fischeri, Oust. Bibl. École Hautes Études, xxxi. art. 10 (1886).

a. ♂. Goura, Sept. 14, 1894. Iris dark brown; feet salmon-colour; bill dull vermilion.

b. ♂. Bussarler, Nov. 28, 1894. Iris brown; bill and feet salmon-colour.

Somali-land must be one of the northern limits of the range of this species. It was procured by Dr. Ragazzi at Soddè in Shoa in August. Dr. Reichenow records it from Usegúha and the plains south of Kilima-njaro.

16. STEGANURA PARADISEA.

Vidua paradisea orientalis, Heugl. Orn. N.O.-Afr. i. p. 583 (1869).

Vidua verreauxi, Heugl. Orn. N.O.-Afr. iv. p. cxxxiv (1874); Salvad. Ann. Mus. Genov. (2) vi. p. 286 (1888).

Steganura paradisea (L.); Sharpe, Cat. B. Brit. Mus. xiii. p. 211 (1890); Reichen. Vög. Deutsch-Ost-Afr. p. 192 (1894).

Vidua paradisea, Oust. Bibl. École Hautes Études, xxxi. art. 10, p. 10 (1886).

a, b. ♂ ad. Smith River, Sept. 11, 1894. Iris dark brown. Breeding.

c. ♂ ad.; *d.* ♂ juv. Darro Mountains, Nov. 20, 1894. Iris and feet brown.

Heuglin doubts whether this is a resident species in North-east Africa, as he only observed it between the months of May and December. It does not extend beyond 17° N. lat., but reaches a height of 6000–7000 feet in Abyssinia. It is common in Bogos, Abyssinia, Senar, Kordofan, and the whole district of the White Nile. In Shoa it seems to be rare, as Antinori did not procure specimens, and Dr. Ragazzi only got one at Ambokarra in May. Dr. Reichenow gives its distribution in German East Africa as extending from Dar-es-Salaam up to the Victoria Nyanza, his list of localities being too large to quote.

17. PYROMELANA FRANCISCANA.

Euplectes franciscanus (Isert); Heugl. Orn. N.O.-Afr. i. p. 571 (1871); Salvad. Ann. Mus. Gen. (2) i. p. 184, vi. p. 288 (1888).

Pyromelana franciscana, Shelley, Ibis, 1885, p. 409; Oust. Bibl. Écoles Hautes Études, xxxi. art. 10, p. 10 (1886); Sharpe, Cat. B. Brit. Mus. xiii. p. 233 (1890); id. Ibis, 1891, p. 248.

A migrant in North-eastern Africa, according to Heuglin, arriving from the interior in June and July. It is especially common in the lowlands of Abyssinia, extending to 1000 feet; as well as in Takah, Senar, Kordofan, and Nubia. Its most northern limit on the Nile is 22° N. lat. In Shoa, Antinori states that it arrives in May, and he procured specimens from May to September. Dr. Ragazzi also met with the species in Shoa from the end of April to August. Mr. Jackson procured a male at Elgeyo in July, but it is not included in Dr. Reichenow's list of the birds of German East Africa.

18. PYROMELANA XANTHOMELÆNA.

Euplectes capensis, var. *minor*, Heugl. Orn. N.O.-Afr. i. p. 573 (1871).

Pyromelana xanthomelæna (Rüpp.); Sharpe, Cat. B. Brit. Mus. xiii. p. 239 (1890); id. Ibis, 1891, p. 248.

Euplectes xanthomelas, Salvad. Ann. Mus. Genov. (2) i. p. 186 (1884), vi. p. 109 (1888).

Orynx xanthomelas, Reichen. Vög. Deutsch-Ost-Afr. p. 190 (1894).

a. ♂ imm. Budda, Nov. 4, 1894. Feet and iris brown.

Found by Rüppell in the provinces of Tembién and Semién in Abyssinia. Heuglin met with this species in the highlands of Wogara, up to 8000 to 10,000 feet. Antinori says that he found it in the country of the Kidj Negroes on the Upper White Nile, where Heuglin never observed it. From May to October Antinori found this Weaver-bird in Shoa, where it was common in the "Kolla" districts, and Ragazzi procured specimens from Antoto in December. Mr. Jackson met with it on Mount Elgon in December, and at Elgeyo in July; while Dr. Reichenow gives several places where the species has been procured in German East Africa.

19. PHILETÆRUS CABANISI.

Philæterus cabanisi (F. & R.); Sharpe, Cat. B. Brit. Mus. xiii. p. 251 (1890).

Nigrita cabanisi, Reichen. Vög. Deutsch-Ost-Afr. p. 184 (1894).

a, b, c. ♂ ad.; *d.* ♀ ad. Dabulla, July 16. Bill silvery white; feet brownish flesh-colour; iris orange.

This is a considerable extension of the northward range of this Weaver-bird, which was only known before from the Masai country.

20. QUELEA ÆTHIOPICA.

Hyphantica æthiopica (Sund.); Heugl. Orn. N.O.-Afr. p. 543 (1871).

Quelea æthiopica, Salvad. Ann. Mus. Gen. (2) i. p. 193 (1884), vi. p. 293 (1888); Sharpe, Cat. B. Brit. Mus. xiii. p. 259 (1890); id. Ibis, 1891, p. 250.

Ploceus sanguinirostris, var. *æthiopicus*, Oust. Bibl. École Hautes Études, xxxi. art. 10, p. 10 (1886).

a. ♂; *b.* ♀. Shebeli River, Aug. 28, 1894. Iris reddish brown; bill red; feet dark flesh-colour; eyelids raw-sienna. In the female the iris was brown.

c. ♀ ad. Sillul, Aug. 6, 1874. Bill pale carmine; feet flesh-colour; iris light brown; eyelid yellow-ochre.

d. ♀ ad. Sillul, Aug. 6, 1894. Bill and eyelids pale yellow; feet flesh-colour; iris light brown.

The way in which the black varies in extent on the lores in this series makes me very doubtful of the validity of *Q. intermedia*.

According to Heuglin, this species is a migrant in Kordofan, Senar, Southern Nubia, and Takah with the first summer rains. It inhabits the mountains, up to 6000 feet, as far east as Bogosland. It goes southwards in September and October, and he met with numbers of this bird in the White Nile district in January.

In November and April, Antinori saw the species in Shoa, at Diambi and Lake Cialalakà, and Dr. Ragazzi procured it at Soddè in August. Mr. Jackson appears to have shot specimens only in the Teita district, and Dr. Reichenow gives the following localities for *Q. intermedia*:—Pangani, Usegùha, Ugogo, Parè Mountains, Nguruman, Kageije, Igonda.

21. AMADINA FASCIATA.

Sporothlastes fasciatus (Gm.); Heugl. Orn. N.O.-Afr. i. p. 596 (1871).

Amadina fasciata (Gm.); Salvad. Ann. Mus. Gen. (2) i. p. 179 (1884), vi. p. 283 (1888); Sharpe, Cat. B. Brit. Mus. xiii. p. 289 (1890); Reichen. Vög. Deutsch-Ost-Afr. p. 183 (1894).

a. ♂ ad. Lammo, Aug. 12, 1894. Breeding.

b, *c*. ♂ ♀ ad. Goura, Sept. 14, 1894. Bill grey; feet flesh-colour; iris reddish brown.

Inhabits the Abyssinian coast-lands northwards to 17° N. lat., Kordofan, and many localities in the White Nile district; and Heuglin observed it during and after the rainy season up to December. Antinori found the species in the country of the Req Negroes. The last-named naturalist also met with it in Shoa in May, and again in November and December, and Dr. Ragazzi found it near Tofan in August, in great flocks. It extends also into German East Africa, as Dr. Reichenow records it from Usegùha, Nguruman, and the Wembaere Steppes.

22. ÆDEMOSYNE CANTANS.

Uroloncha cantans (Gm.); Heugl. Orn. N.O.-Afr. i. p. 594 (1871).

Munia cantans, Salvad. Ann. Mus. Genov. (2) vi. p. 284 (1888).

Aidemosyne cantans, Sharpe, Cat. B. Brit. Mus. xiii. p. 371 (1890).

a, *b*. ♂ ♀ ad. Sillul, Aug. 6, 1894. Bill dark slate-colour; feet light slate-colour; iris dark brown.

c. ♂ ad. Sillul, Aug. 10.

Heuglin says that this species occurs in pairs or in small flocks, which are scattered, during the rainy season, from Dongola, southwards to Kordofan, Senar, Abyssinia, on the Lower White Nile, and on the coast of Somali-land. It breeds from August to October, and Vierthaler found a nest in January. Dr. Ragazzi once obtained it in Shoa at Soddè in August.

23. ESTRELDA RHODOPYGA.

Habropyga frenata (Licht. MSS.); Heugl. Orn. N.O.-Afr. i. p. 605 (1871).

Estrelda rhodopyga, Sund.; Salvad. Ann. Mus. Gen. (2) vi. p. 282 (1888); Sharpe, Cat. B. Brit. Mus. xiii. p. 396 (1890); Reichen. Vög. Deutsch-Ost-Afr. p. 187 (1894).

a. ♀ ad. Webbe Shebeli, Aug. 28, 1894. Iris light brown.
b. Imm. Sheik Husein, Sept. 29, 1894. Iris dark brown; feet dark grey.

Heuglin says that he obtained a pair of this species near Keren in Bogos-land during the rainy season. Dr. Ragazzi met with it at Soddè in Shoa in August, and Dr. Reichenow records it from Bussisi.

24. ESTRELDA NIGRIMENTUM.

Estrelda nigrimentum, Salvad. Ann. Mus. Genov. (2) vi. p. 281 (1888); Sharpe, Cat. B. Brit. Mus. xiii. p. 399 (1890).

a. Ad. Bussarler, Nov. 28, 1894. Iris reddish brown; bill grey.

This beautiful little Waxbill was discovered by Dr. Ragazzi at Farrè in Shoa, in February 1886.

25. ESTRELDA PHŒNICOTIS.

Uræginthus phœnicotis (Sw.); Heugl. Orn. N.O.-Afr. i. p. 619 (1871); Salvad. Ann. Mus. Genov. (2) i. p. 177 (1884), vi. p. 279 (1888).

Estrelda phœnicotis (Swains.); Sharpe, Cat. B. Brit. Mus. xiii. p. 400 (1890); id. Ibis, 1891, p. 251.

a. ♀ ad. Luku, Sept. 17, 1894. Iris light brown; feet light brown; bill dark pink at the base, black at apex.
b, c. ♂ ad. Sheik Husein, Oct. 13, 15, 1894. Iris red; bill dark pink, black at tip; feet light brown. Caught on nest no. 12.

Heuglin states that this species is found in Abyssinia up to 7000 feet in Takah, Senar, on the White Nile, and in Kordofan, nowhere plentifully and never in flocks, but generally singly or in pairs. It is a resident and breeds. In Shoa it is also common and stationary, according to Antinori, but here it is found in little flocks. His dates are between April and November, and Dr. Ragazzi procured the species in February and March. Mr. Jackson did not meet with it, nor is it recorded by Dr. Reichenow from German East Africa.

26. GRANATINA IANTHOGASTRA.

Uræginthus ianthinogaster, Shelley, Ibis, 1885, p. 408; Salvad. Ann. Mus. Genov. (2) vi. p. 279 (1888).

Granatina ianthogastra (Reichen.); Sharpe, Cat. B. Brit. Mus. xiii. p. 404 (1890); Reichen. Vög. Deutsch-Ost-Afr. p. 186 (1894).

a. ♂ ad. Milmil, July 26, 1894. Iris and eyelid red.
b. ♂ juv. Okoto, Sept. 7, 1894. Iris and eyelid light brown; bill pink; legs grey.
c. ♀ ad. Sheik Husein, Sept. 24, 1894. Iris scarlet; bill vermilion.
d, e. ♂ ad. Sheik Husein, Sept. 29, 1894. Iris Indian red; bill and eyelids vermilion; legs grey.

This is a Somali species, which extends its range southwards into East Africa, as Dr. Reichenow records it from the Konga River, Aruscha, Masai-land, and Ugogo. Dr. Ragazzi has also obtained it in Shoa at the Falls of Farrè, near Dinghai Mesghià, in March.

27. HETERHYPHANTES EMINI.

Sycobrotus emini, Hartl. Orn. Centralbl. 1882, p. 92.

Heterhyphantes emini, Sharpe, Cat. B. Brit. Mus. xiii. p. 420 (1890).

a. Imm. Sheik Mahomed, Nov. 7, 1894. Bill black; iris white; feet light brown.

It is interesting to find this Equatorial African species in Western Somali-land.

28. HYPHANTORNIS GALBULA.

Hyphantornis galbula (Rüpp.); Heugl. Orn. N.O.-Afr. i. p. 557, tab. xviii. fig. D (1871); Salvad. Ann. Mus. Genov. (2) i. p. 191 (1884), vi. p. 291 (1888); Sharpe, Cat. B. Brit. Mus. xiii. p. 442 (1890).

a, *b*. ♂ ad.; *c*, *d*. ♀ ad. Boholgarshan, July 15, 1894.

Heuglin says that the range of this Weaver-bird is from 19° N. lat. southwards to the district of the Eisa Somalis; it is most plentiful in Sambar and Bogos-land, from the sea-shore up to 6000 feet. In the interior of Abyssinia, the eastern districts of Tigrié, it appears much less frequently, as in the Nile region. On the Bischarin Mountains it extends to the neighbourhood of Suakin. In Shoa, Antinori procured specimens from March to August, and Dr. Ragazzi records the species as common and breeding near the Farrè Falls.

29. HYPHANTORNIS VITELLINA.

Hyphantornis vitellina (Licht.); Heugl. Orn. N.O.-Afr. i. p. 555, tab. xviii. fig. C (1871); Sharpe, Cat. B. Brit. Mus. xiii. p. 462 (1890); id. Ibis, 1891, p. 254.

a, *b*. ♂ ad. Darro Mountains, Sept. 15, 1894. Iris orange; feet light brown.

This Weaver-bird, according to Heuglin, appears at the end of May and June in the region of the Lower Blue and White Niles, and on the Nile itself north to Berber. It appears not to occur in Shoa, but was found by Mr. Jackson at Kamassia.

30. CINNAMOPTERYX RUBIGINOSA.

Hyphantornis rubiginosa (Rüpp.); Heugl. Orn. N.O.-Afr. i. p. 560 (1871).

Cinnamopteryx rubiginosa (Rüpp.); Sharpe, Cat. B. Brit. Mus. xiii. p. 473 (1890); id. Ibis, 1891, p. 254.

Ploceus rubiginosus, Reichen. Vög. Deutsch-Ost-Afr. p. 180 (1895).

a. ♂ ad. Darar, Sept. 15, 1894. Iris reddish brown; feet and toes grey.

Found by Rüppell in the warmer valleys in Abyssinia, but appears to be local, and apparently migratory. Heuglin himself never met with the species, but Mr. Jackson procured it near Lake Baringo, and Dr. Reichenow records it from Ugogo and Igonda.

31. DINEMELLIA DINEMELLI.

Textor dinemelli (Rüpp. ex Horsf. MSS.); Heugl. Orn. N.O.-Afr. i. p. 534 (1871); Salvad. Ann. Mus. Genov. (2) i. p. 194 (1884); Shelley, Ibis, 1885, p. 410.

Dinemellia dinemelli (Rüpp.), Sharpe, Cat. B. Brit. Mus. xiii. p. 506 (1890); id. Ibis, 1891, p. 255; Salvad. Mem. R. Accad. Torino, xliv. p. 558 (1894: Banan); Reichen. Vög. Deutsch-Ost-Afr. p. 178 (1894).

a. ♀ ad. Dullaat, July 13, 1894.
b. ♂ ad. Boholgarshan, July 15, 1894.
c. ♂ ad. Hargeisa, July 18, 1894.

Met with by Heuglin on the Upper White Nile in winter and spring, especially in the country of the Kidj Negroes, from Olibo and Belinian. Antinori procured specimens in August in Shoa. Mr. Jackson found the species as far south as Teita, and it has been procured in the Oseri River in the Kilima-njaro district.

Fam. FRINGILLIDÆ.

32. PASSER SWAINSONI.

Passer swainsoni (Rüpp.); Salvad. Ann. Mus. Genov. (2) i. p. 176 (1884); Heugl. Orn. N.O.-Afr. i. p. 634 (1871); Oust. t. c. p. 9 (1886); Sharpe, Cat. B. Brit. Mus. xii. p. 334 (1888); id. Ibis, 1891, p. 257.

a. ♀. Sheik Husein, Sept. 26, 1894. Iris dark brown; angle of mouth yellow; eyes brown.

b. ♂. Sheik Husein, Sept. 26, 1894. Bill black; legs brown; iris rich brown.

Heuglin says that this Sparrow lives in pairs in Kordofan, on the White and Blue Niles, in Uniamuezi, Abyssinia, Bogos-land, and Takah, and is everywhere resident. It is also the resident Sparrow of Shoa, according to Antinori, and occurs as far south as Ukambani, where it was found by Mr. Jackson. In German East Africa its place is taken by *P. diffusus*, according to Dr. Reichenow.

33. PETRONIA PYRGITA.

Xanthodina pyrgita, Heugl. Orn. N.O.-Afr. i. p. 627, pl. xxi. fig. 2.

Gymnorhis pyrgita, Heugl. t. c. App. p. cxl; Shelley, Ibis, 1885, p. 408.

Petronia pyrgita, Sharpe, Cat. B. Brit. Mus. xii. p. 296 (1888); Reichen. Vög. Deutsch-Ost-Afr. p. 195 (1894).

a. ♂ ad. Shebeli, Aug. 25, 1894. Iris light brown.

b, c. ♂ ♀ ad. Okoto, Sept. 7, 1894. Iris dark brown; bill light horn-colour; legs grey.

d. ♀ ad. Furza, Sept. 12, 1894. Iris brown; bill and feet grey.

Mr. Lort Phillips only observed these Sparrows on one occasion near the centre of the plateau. Heuglin only met with the species in the wooded region on the western slope of the Bogos Mountains towards the lowlands of Barka. According to Dr. Reichenow, it is found as far south as Teita.

34. SERINUS DONALDSONI. (Plate XXVII. fig. 2.)

Serinus donaldsoni, Sharpe, Bull. B. O. Club, iv. p. xli (1895).

S. *major. Similis* S. capistratæ ♀, *sed subtus concolor, gutture minime maculato: hypochondriis nigro striolatis: fronte viridi, pileo concolore, anguste nigro striolato: supercilio lato flavo: notæo viridi, plumis nigro medialiter striatis; uropygio læte flavo distinguendus. Long. tot.* 6·2 *poll., culm.* 0·55, *alæ* 3·3, *caudæ* 2·55, *tarsi* 0·65.

a. ♂ ad. Smith River, Sept. 10, 1894. Bill flesh-colour; iris dark brown. Mr. Gillett also obtained a specimen in the same district.

This large species of Seed-eater is of the size of *Serinus sulphuratus*, but has the colouring of some of the smaller kinds, such as *S. flaviventris*. The characters given above, however, will distinguish the species. It comes into the second section of the genus *Serinus*, as given by me in the 12th volume of the 'Catalogue of Birds,' p. 349, with the flanks streaked with dusky blackish, no yellow frontal patch, but the eyebrow yellow. This would make it an ally of *S. capistratus*, but it is enormously larger and has no streaks or spots on the throat, the whole under surface being bright yellow. It may also be considered a large edition of *S. imberbis*, but its streaked flanks and the white margins of the inner secondaries distinguish it.

35. SERINUS MACULICOLLIS. (Plate XXVII. fig. 1.)

Serinus maculicollis, Sharpe, Bull. Brit. Orn. Club, iv. p. xli (1895).

♂. S. *hypochondriis distincte nigro striolatis: fascia frontali angusta, superciliis, macula auriculari, gutture et pectore totis læte flavis: abdomine toto albo, distinguendus. Long. tot.* 4·4 *poll., culm.* 0·35, *alæ* 2·7, *caudæ* 1·7, *tarsi* 0·6.

♀ *mari similis, sed gula albida, torque gutturali nigro distinguenda. Long. tot.* 4·3 *poll., alæ* 2·6.

This is a curious little Serin Finch, which is apparently unnamed. The yellow colour of the bird is everywhere brighter than in the Canary (*Serinus canarius*), which appears to be its nearest ally, and the white belly is also a conspicuous feature, while the collar of black spots on the fore-neck of the female is quite remarkable. The male has a greyish band across the lower throat.

36. EMBERIZA POLIOPLEURA.

Fringillaria poliopleura, Salvad. Ann. Mus. Civic. Genov. (2) vi. p. 269 (1888).

a. ♂. Sibbe, Aug. 4, 1894. Mr. Gillett obtained a male on the Shebeli.
b. ♂. Ehrer, Aug. 16, 1894.
c. Juv. Sheik Husein, Oct. 1, 1894. Iris dark brown; feet light brown.

This species was discovered by Dr. Ragazzi at Soddè in Shoa, where it was pronounced by him to be rare. Count Salvadori (*l. c.*) has given some excellent notes on the Buntings of this group, and considers *Emberiza affinis* (Heugl.) to be a distinct species.

Fam. ALAUDIDÆ.

37. TEPHROCORYS RUFICEPS.

Calandritis anderssoni (nec Tristr.), Heugl. Orn. N.O.-Afr. i. pt. 2, p. 699 (1871).

Tephrocorys ruficeps (Rüpp.); Sharpe, Cat. B. Brit. Mus. xiii. p. 563 (1890).

Calandritis ruficeps, Heugl. t. c. p. 698; Salvad. Ann. Mus. Genov. (2) i. p. 170 (1884).

Calandrella ruficeps, Salvad. Ann. Mus. Genov. (2) vi. p. 268.

a, *b*. ♂ ad. Sheik Mahomed, Nov. 13, 1894. Iris and legs brown.

Heuglin says that this species represents our Skylark in the high mountains of Abyssinia, where it is found between 6000 and 11,000 feet. He found it to the north in Hamasien, southwards to the Woho-Gala Mountains, and not to the westward beyond the Tana Lake. In Shoa, Antinori found it in June and November, and Dr. Ragazzi at Fallè, in the Mulo Galla country, in December and January.

38. SPIZOCORYS PERSONATA, n. sp.

a. ♂ ad. Sassabana, Aug. 3, 1894.

As this specimen is moulting, it is extremely difficult to determine the exact genus it should be placed in; but it has a very diminutive first primary, and I think that it will prove to be a second species of *Spizocorys*. From *S. curvirostris* it is easily distinguished by its vinous breast and abdomen, grey ear-coverts, sides of neck and fore-neck, forming a band across the latter and separating the white throat from the vinous breast. It is also remarkable for the black lores and region of the eyes, the black descending obliquely across the throat and joining a black streak along the anterior malar region.

39. ALAUDULA SOMALICA, n. sp.

A. *similis* A. minori, *sed major et rostro conspicue longiore, abdomine albo, subalaribus arenariis et fascia nigra conspicua rictali distinguenda. Long. tot.* 5·7 *poll., culm.* 0·55, *alæ* 3·5, *caudæ* 1·95, *tarsi* 0·85.

a. ♂. The Haud, July 23, 1894.

Owing to the specimens being in moult, I have had the utmost difficulty in determining the Larks in Dr. Smith's collection, and I am not certain whether the species above described is an *Alaudula* or a *Calandrella*. If of the latter genus, it has no near ally, as it has distinct black spots on the throat. In the genus *Alaudula* it will find its nearest ally in *A. minor*; but it is a larger bird, with a much longer bill and rufescent under wing-coverts; above all, it is distinguished by the black band which runs from the gape to below the hinder part of the eye.

40. MIRAFRA GILLETTI.

Mirafra gilletti, Sharpe, Bull. B. O. Club, iv. p. xxix.

a. Ad. Sibbe, Aug. 4, 1894.

This seems to be quite a distinct species, distinguished by its ashy-brown rump and upper tail-coverts.

41. GALERITA CRISTATA.

Galerita cristata (Linn.); Heugl. N.O.-Afr. i. p. 680 (1871); Oust. Bibl. École Hautes Études, xxxi. art. 10, p. 8 (1886); Sharpe, Cat. B. Brit. Mus. xiii. p. 626 (1890).

a. Berbera, July 4, 1894.

Belongs to the rufous-tailed race of the Crested Lark (*G. senegalensis*).

42. AMMOMANES DESERTI.

Ammomanes deserti (Licht.); Heugl. Orn. N. O.-Afr. i. p. 684 (1871); Sharpe, Cat. B. Brit. Mus. xiii. p. 646 (1890).

a, b. ♂ ad. Ardeh, July 14, 1894.

This record appears to extend the range of the Desert Lark somewhat further to the southward, as Heuglin only regarded it as a possible inhabitant of the coast district of Somali-land, though he recorded its southern range as 15° N. lat. in Nubia and on the Abyssinian coast-lands, but not occurring in Abyssinia proper.

43. PYRRHULAUDA MELANAUCHEN.

Coraphites melanauchen, Cab.; Heugl. Orn. N.O.-Afr. i. p. 672 (1871).

Pyrrhulauda melanauchen, Sharpe, Cat. B. Brit. Mus. xiii. p. 655 (1890).

a. ♂. Berbera, July 3, 1894.

Heuglin gives the range of this little species as along the African coast of the Red Sea and on the Dahlak Islands. Without doubt, he says, it will be found to occur on the coast of Hedjas, and near Berbera in Somali-land. Thus Heuglin's prophecy as to its occurrence at Berbera has been fulfilled by Dr. Donaldson Smith.

Fam. MOTACILLIDÆ.

44. MOTACILLA VIDUA.

Motacilla vidua, Sund.: Heugl. Orn. N.O.-Afr. i. p. 317 (1869); Sharpe, Cat. B. Brit. Mus. x. p. 488 (1885); Reichen. Vög. Deutsch-Ost-Afr. p. 200 (1894).

a, *b*. Imm. Shebeli, Aug. 28, 1894. Iris brown.

Resident in North-eastern Africa, according to Heuglin, but very local. Found in pairs in Southern Egypt and Nubia, southwards to Assouan, only along the Nile. It is also found on the White Nile, on the Atbara, the Azrag, and according to Rüppell in Abyssinia. Dr. Reichenow gives many localities, ranging from the Pangani River and Ugogo to the Victoria Nyanza.

45. MOTACILLA FLAVA.

Motacilla flava, Linn.; Heugl. Orn. N.O.-Afr. i. p. 320 (1869); Sharpe, Cat. B. Brit. Mus. x. p. 516, pl. vi. figs. 3–5 (1885).

Budytes flavus, Salvad. Ann. Mus. Genov. (2) i. p. 166 (1884); Reichen. Vög. Deutsch-Ost-Afr. p. 200 (1894).

a. ♀ ad. Sheik Husein, Sept. 19, 1894. Iris and feet dark brown; bill black, the base of the under mandible yellow-ochre.

Heuglin found Yellow Wagtails in Egypt, Arabia, Nubia, on the White Nile and Gazelle Rivers, in Abyssinia and Bogos-land, and on the Somali coast.

In Shoa, Antinori met with it in November, and again on the 1st of May at Mahal-Uonz. Dr. Reichenow gives a long list of localities in East Africa from which he has seen specimens.

46. ANTHUS TRIVIALIS.

Anthus arboreus (Gm.); Heugl. Orn. N.O.-Afr. i. p. 324 (1869).

Anthus trivialis (Linn.); Sharpe, Cat. B. Brit. Mus. x. p. 543 (1885); id. Ibis, 1891, p. 588; Reichen. Vög. Deutsch-Ost-Afr. p. 199 (1894).

a. ♂ ad. Sheik Husein, Sept. 29, 1894. Iris dark brown; legs and under mandible very light grey.

A somewhat scarce winter visitant in Egypt, according to Heuglin. Hemprich and Ehrenberg met with it in Nubia and Arabia, and Lefebvre in September at Schiriè in East Abyssinia. Mr. Jackson procured it on Mt. Elgon at 8000 feet in February, and Dr. Reichenow records it from Kakoma.

47. TMETOTHYLACUS TENELLUS.

Anthus tenellus (Cab.); Sharpe Cat. B. Brit. Mus. x. p. 618.

Macronyx tenellus, Oust. Bibl. École Hautes Études, xxxi. art. 10, p. 8 (1886); Reichen. Vög. Deutsch-Ost-Afr. p. 200 (1894).

Tmetothylacus tenellus, Salvad. Mem. R. Accad. Sci. Torino, (2) xliv. p. 557 (1894: Lido Mountains).

a. ♀ imm. Darar, Sept. 15, 1894. Iris dark brown; bill dark grey, the under mandible lighter; feet light brown.

Has been found in the Parè Mountains by Dr. Fischer.

Fam. NECTARINIIDÆ.

48. CINNYRIS OSIRIS.

Nectarinia osiris, Finsch, Tr. Zool. Soc. vii. p. 230 (1870).

Cinnyris osiris (Finsch); Shelley, Monogr. Nect. p. 215, pl. 64. fig. 1; Salvad. Ann. Mus. Genov. (2) i. p. 140 (1884), vi. p. 245 (1888); Sharpe, Ibis, 1891, p. 593.

a. ♂ ad. Milmil, July 26, 1894.

b, c. ♂ ad. Sheik Husein, Sept. 25, 1894.

Found by Antinori on the elevated "Kolla" lands of Shoa, where it seems to be common. Mr. Jackson procured it as far south as Machako's, and Mr. Lort Phillips has lately met with the species on the Goolis Mountains.

49. CINNYRIS ALBIVENTRIS.

Nectarinia albiventris, Strickl.; Heugl. Orn. N.O.-Afr. i. p. 234 (1869).

Cinnyris albiventris, Shelley, Monogr. Nect. pl. 73 (1876); Salvad. Mem. R. Accad. Torino, (2) xliv. p. 556 (1894: Mandera, Goolis Mts.).

a. ♂ ad. The Haud, July 22, 1894.

b, c. ♂ ad. Gardubbla, Aug. 15, 1894.

d. ♂ ad. Shebeli, Sept. 6, 1894. Iris dark brown: breeding.

This species was only known to Heuglin from the Somali plateau.

50. CINNYRIS HABESSINICA.

Nectarinia habessinica, H. & E.; Heugl. Orn. N.O.-Afr. i. p. 229 (1871).

Cinnyris habessinica, Shelley, Monogr. Nect. pl. 63 (1878); Salvad. Ann. Mus. Genov. (2) i. p. 139 (1884); Shelley, Ibis, 1885, p. 406; Salvad. t. c. p. 556 (1894: Goolis Mts.).

a. ♂ ad. Boholgarshan, July 15, 1894.

b, c. ♂ ad.; *d.* ♀ ad. Selon, Aug. 7, 1894. Iris black. Breeding.

e. ♂ ad. Turfa, Aug. 21, 1894.

f. ♀ ad. Okoto, Sept. 8, 1894. Iris dark brown.

g. ♂ ad. Dada, Nov. 21, 1894. Iris brown.

According to Heuglin, this Sun-bird is found in the country bordering the Red Sea, extending to the mountains near Suakin, and to those south of the Somali coast. It is found from the sea-coast up to 3000 and 4000 feet, but was not seen in the interior of Abyssinia; it is not rare in Takah. Heuglin thinks that Harris's specimens, said to have been procured in Shoa, must really have been obtained on the Adail coast; but Antinori states that it is common during the whole year in the low as well as the high "Kolla."

51. Chalcomitra hunteri.

Chalcomitra hunteri, Shelley, P. Z. S. 1889, p. 365, pl. xli. fig. 2 (Oseri River); Salvad. t. c. p. 556 (1894: Goolis Mts.).

Cinnyris hunteri, Sharpe, Ibis, 1891, p. 592; Reichen. Vög. Deutsch-Ost-Afr. p. 210 (1894).

a. Ad. Sillul, Aug. 5, 1894.

This Sun-bird was discovered by Mr. Hunter on the Oseri River in the Kilima-njaro district. Mr. Jackson met with it on the Voi River in Teita in December.

Count Salvadori has recently recorded the species from the Goolis Mountains, where, however, Mr. Lort Phillips has not yet found it.

52. Anthothreptes orientalis.

Anthreptes orientalis, Hartl. J. f. O. 1880, p. 213.

Anthreptes longuemarii (Less.); Shelley, P. Z. S. 1888, p. 39.

Anthothreptes longuemarii, Sharpe, Ibis, 1891, p. 594.

Antrotreptes longuemarii, Reichen. Vög. Deutsch-Ost-Afr. p. 209 (1894).

a. ♀ ad. Okoto, Sept. 8, 1894. Iris dark brown.
b. ♂ ad. Smith's River, Sept. 10, 1894.
c. Ad. Dabulli, Sept. 16, 1894.

These specimens agree with others from Equatorial Africa collected by Emin Pasha. *A. orientalis* seems to me always to be distinguishable by the bright metallic-green band across the lower back, this band being absent in *A. longuemarii*.

The species obtained by Heuglin on the Wa River in April was doubtless *A. orientalis*, and he also met with it in winter plumage in January. Antinori procured the same bird in the Djur and Dor districts. It is certainly the species procured by Mr. Jackson from the Teita district, and I have little doubt that it is also the form recorded from so many places in Eastern Africa by Dr. Reichenow.

Fam. ZOSTEROPIDÆ.

53. Zosterops flavilateralis.

Zosterops flavilateralis, Reichen. J. f. O. 1892, p. 192; id. Vög. Deutsch-Ost-Afr. p. 208 (1894).

Zosterops tenella, Hartl.; Oust. Bibl. École Hautes Études, xxxi art. 10, p. 8 (1886).

a. ♂ ad. Sillul, Aug. 7, 1894. Iris light brown. Feet dark grey.

I believe that I have correctly identified this species, which is recorded by Dr. Reichenow from Masai-land on the Maeru Mountains, Aruscha, and Kilima-njaro.

Fam. PARIDÆ.

54. PARUS THRUPPI.

Parus thruppi, Shelley, Ibis, 1885, p. 406, pl. xi. fig. 2.

a. ♂ ad. Milmil, July 27, 1894.

Discovered by Mr. Lort Phillips near the centre of the Somali plateau.

55. ÆGITHALUS MUSCULUS.

Ægithalus musculus, Hartl.; Shelley, P. Z. S. 1888, p. 29.

a, *b*. ♂ ad. Okoto, Sept. 8, 1894. Iris dark brown; legs bluish grey.

This is an Equatorial species, which has not hitherto been recorded from Somali-land or East Africa.

Fam. LANIIDÆ.

56. LANIUS ISABELLINUS.

Lanius isabellinus, H. & E.; Heugl. Orn. N.O.-Afr. ii. p. 475 (1871); Gadow, Cat. B. Brit. Mus. viii. p. 277 (1883); Reichen. Vög. Deutsch-Ost-Afr. p. 158 (1894).

a. ♂ ad. Bunker Dagabourh, Dec. 22, 1894. Iris brown.

Not plentiful in North-eastern Africa, south of 15° N. lat. in Kordofan; on the White Nile, in Senar, and in Abyssinia; obtained by Ehrenberg near Quofuda, on the Arabian coast (Heuglin). It is a winter visitor to East Africa, according to Dr. Reichenow, and has been obtained at Bagamoyo, on the Pangani River, the Wembaere Steppes, Tavéta, and Bukoba.

57. LANIUS HUMERALIS.

Lanius humeralis, Stanl.; Heugl. Orn. N.O.-Afr. i. p. 486 (1871); Salvad. Ann. Mus. Genov. (2) i. p. 130 (1884), vi. p. 240 (1888); Sharpe, Ibis, 1891, p. 597; Reichen. Vög. Deutsch-Ost-Afr. p. 157 (1894).

a. ♂ ad. Tuago, Oct. 27, 1894. Iris dark brown.

Heuglin says that this is a very common bird in Abyssinia, apparently a resident, but not found above 8000–10,000 feet. He collected it northwards to the Province of Takah, and to the southward to Fazogl, more rarely in Southern Kordofan, and on the White Nile.

In Shoa the present species was met with by Antinori at Mahal-

Uonz from March to August, breeding in June. Dr. Ragazzi also records it from various localities in Shoa between November and June. Mr. Jackson procured it in Elgeyo (July), in Kikuyu (August), and on Mount Elgon (February); and, according to Dr. Reichenow, it extends south to Igónda, Kilima-njaro, Aruscha, and Bukoba.

58. Lanius antinorii.

Lanius antinorii, Salvad.; Gadow, Cat. B. Brit. Mus. viii. p. 255 (1883).

a. ♂ ad. Labarouk, July 12, 1894.
b. ♀ ad. The Haud, July 24, 1894.

These specimens are undoubtedly *L. antinorii*, but Mr. Gillett obtained a specimen near Gelaydee which is the true *L. dorsalis*, Cab., as also is Mr. Lort Phillips's example recorded by Capt. Shelley from Somali-land ('Ibis,' 1885, p. 401). Mr. Jackson's specimen from Turquel ('Ibis,' 1891, p. 295) is also true *L. dorsalis*, with black inner secondaries. I should not be surprised, notwithstanding that Dr. Smith's specimens are determined as male and female, to learn that *L. antinorii* and *L. dorsalis* are sexes of the same species. *Cf.* Salvadori, Mem. R. Accad. Torino, (2) xliv. p. 555 (1894).

59. Laniarius cruentus.

Dryoscopus cruentus (Rüpp.); Heugl. Orn. N.O.-Afr. i. p. 462 (1871).

Laniarius cruentus (H. & E.); Gadow, Cat. B. Brit. Mus. viii. p. 152 (1883); Shelley, Ibis, 1885, p. 402.

Rhodophoneus cruentus, Salvad. Mem. R. Accad. Torino, (2) xliv. p. 555 (1894).

a. ♀ ad. The Haud, July 25, 1894.
b. ♀ ad. Dacheto, Aug. 10, 1894. Iris light brown; legs grey.
c. ♂ ad. Sheik Husein, Sept. 23, 1894. Iris dark brown; legs light grey.

According to Heuglin, the range of this species is decidedly restricted to certain districts. He found it only along the African coast of the Red Sea from Suakin south to Adël-land, and he considers it to be a bird of the lowlands rather than of the mountains, which it seldom visits.

60. Laniarius poliocephalus.

Meristes olivaceus (nec V.); Heugl. Orn. N.O.-Afr. i. p. 466 (1871).

Laniarius poliocephalus (Licht.); Gadow, Cat. B. Brit. Mus. viii. p. 156 (1883)

a. Ad. Bainhou, Jan. 10, 1895. Iris golden yellow; legs grey.

Antinori considered this species to extend no further than 8° or

9° N. lat., and to be migratory between the 20th of February and the 10th of March on the Upper Nile. Heuglin, on the other hand, believed the species to be resident, as he met with it in November and December, and again in March, on the plains of Hamedo in the Abyssinian lowlands, in April in the "Quola" of Western Abyssinia, in Kordofan in July, and in Bongo between August and November.

In Shoa Antinori met with the allied species *L. hypopyrrhus.*

61. Dryoscopus æthiopicus.

Dryoscopus æthiopicus (Gm.); Heugl. Orn. N.O.-Afr. i. p. 458 (1871); Gadow, Cat. B. Brit. Mus. viii. p. 139 (1883); Reichen. Vög. Deutsch-Ost-Afr. p. 163 (1894).

Laniarius æthiopicus, Salvad. Ann. Mus. Genov. (2) i. p. 132 (1884), vi. p. 240 (1888).

a. ♀ ad. Mount Kuldush, Dec. 18, 1894. Iris reddish brown; legs grey.

Found in pairs, according to Heuglin, in Abyssinia and Takah, northwards to 17° N. lat. on the Upper White Nile, less commonly in Senar and Kordofan. It extends up the mountains higher than *D. gambensis*, but not beyond 8000 feet.

Antinori found the species in Shoa, but rather sparsely, near Let-Marafià. Dr. Ragazzi, however, mentions it as common in Shoa. Dr. Reichenow records it from Aruscha, Kilima-njaro, and Karéma.

62. Dryoscopus gambensis.

Dryoscopus gambensis, Licht.; Heugl. Orn. N.O.-Afr. i. p. 456 (1871); Gadow, Cat. B. Brit. Mus. viii. p. 146 (1883); Salvad. Ann. Mus. Genov. (2) vi. p. 241 (1888).

a. ♀ ad. Walenso, Oct. 26, 1894. Iris red; bill, under mandible grey, upper mandible black; legs grey.

A resident in North-eastern Africa, according to Heuglin, by whom it was obtained to the eastward as far as the Anseba River, in Senar, Kordofan, and the region of the Nile. On the mountains of Abyssinia it ascends to 6000 feet. He describes a female bird from the Schir Negroes country on the Upper White Nile. Dr. Ragazzi procured the species in Shoa in the forests of Fekeriè-Ghem, Sciotalit, and the Gherbà Falls.

63. Dryoscopus funebris.

Dryoscopus funebris, Hartl.; Heugl. Orn. N.O.-Afr. i. p. 461 (1871); Gadow, Cat. B. Brit. Mus. viii. p. 133 (1883); Sharpe, Ibis, 1891, p. 598; Reichen. Vög. Deutsch-Ost-Afr. p. 162 (1894).

Laniarius funebris, Salvad. Ann. Mus. Genov. (2) i. p. 133 (1884), vi. p. 241 (1888).

a, b. ♂ ♀ ad. Sillul, Aug. 7, 1894. Iris dark brown.

First obtained by Speke at Meninga in Equatorial Africa. Two specimens, which Count Salvadori believes to be of this species, were obtained by Antinori at Ambo-Karra, in Shoa, in July and August. Dr. Ragazzi obtained a female at Muca in May, but it was not common. It extends south as far as the Teita district, where it was procured by Mr. Jackson at Nzoni, and is widely spread over East Africa down to Ugogo.

64. DRYOSCOPUS RUFINUCHALIS, n. sp.

Similis D. ruficipiti, *sed fronte et vertice nigris, occipite nuchaque rufis distinguendus. Long. tot.* 7·1 *poll., culm.* 0·75, *alæ* 3, *caudæ* 3·15, *tarsi* 1·05.

a. ♂ ad. Dabulli, Sept. 16, 1894. Legs grey; iris dark brown.
b. ♂ ad. Tooloo Duroo, Nov. 25, 1894.
c. Ad. ——?, Dec. 1, 1894.

All Dr. Donaldson Smith's specimens differ from the type in the Lort Phillips collection in having the fore part of the crown black, as well as the forehead. In the typical specimen the forehead only is black, so that there is not half the amount of black on the crown of the head. This may only be sexual. A specimen got by Mr. Gillett is also stated to be a male, like two of those procured by Dr. Smith. On the other hand, it is so remarkable that four specimens obtained on the present expedition should all agree together and all differ from the type in such a marked way, that I have come to the conclusion that the differences are specific.

65. TELEPHONUS JAMESI.

Telephonus jamesi, Shelley, Ibis, 1885, p. 403, pl. x. fig. 2; Oust. t. c. p. 5 (1886).

a. Bussarler, Nov. 28, 1894. Legs grey; iris brown, with light spots.

66. TELEPHONUS BLANFORDI.

Telephonus erythropterus, pt., Heugl. Orn. N.O.-Afr. i. p. 468 (1871).

Telephonus blanfordi, Sharpe; Gadow, Cat. B. Brit. Mus. viii. p. 127, pl. 2. fig. 2 (1883); Salvad. Ann. Mus. Genov. (2) i. p. 119 (1884), vi. p. 242 (1888); Sharpe, Ibis, 1891, p. 600.

a. ♂ ad. Sheik Husein, Sept. 25, 1894. Iris purple, with small white spots; legs bluish grey.

This Bush-Shrike breeds in Shoa, where Antinori met with it at Daimbi in the Adda Galla country and at Let-Marafià, Algaber, Mahal-Uonz, and Denz. Mr. Jackson obtained a specimen at Kitosh in March.

67. NILAUS MINOR, subsp. n.

Nilaus brubru (Lath.); Salvad. t. c. p. 555 (1894).

N. *similis* N. capensi, *sed conspicue minor. Long. tot.* 5·1 *poll., culm.* 0·65, *alæ* 3, *caudæ* 1·9, *tarsi* 0·75.

a. ♂ ad. Milmil, July 2, 1894.
b. ♂ ad. Sibbe, July 3, 1894.
c. ♀ ad. The Haud, July 24, 1894.
d. ♂ ad. Okoto, Sept. 8, 1894. Iris dark brown; legs dark grey.

It is very interesting to find a race of the South-African *N. capensis* in Somali-land, as the N.E.-African *N. afer* or Reichenow's *N. nigritemporalis* might have been expected. I can find no difference between the Somali and Cape examples beyond the conspicuously smaller size of the former and a certain degree of more white at the tips of the inner primaries. The same small race occurs in the Teita district, where a specimen was procured by Sir Robert Harvey.

68. PRIONOPS CRISTATUS.

Prionops poliocephalus (nec Stanl.); Shelley, Ibis, 1885, p. 403; id. P. Z. S.

Prionops cristatus, Sharpe, Ibis, 1892, p. 601.

a. ♂ ad. The Haud, July 24, 1894. Iris and eyelid straw-yellow; legs coral-red.

69. EUROCEPHALUS RUEPPELLI.

Eurocephalus rueppelli, Bp.; Heugl. Orn. N.O.-Afr. i. p. 487; Sharpe, Cat. B. Brit. Mus. iii. p. 280 (1877); Shelley, Ibis, 1885, p. 403; Oust. t. c. p. 5 (1886); Salvad. Ann. Mus. Genov. (2) vi. p. 243 (1888); Reichen. Vög. Deutsch-Ost-Afr. p. 160 (1894).

a. ♂ ad. Milmil, July 28, 1894.
b. Juv. Milmil, July 28, 1894.
c. ♀ ad. Sheik Husein, Sept. 29, 1894. Iris dark brown; eyelids fleshy, black in colour.

The young bird from Milmil has the crown of the head brown, the hinder crown and nape creamy white, the back has obscure pale edges to the feathers, and the wing-coverts are distinctly margined with sandy buff, as also are the inner secondaries. The ear-coverts also are white, with the fore part of the face black, and some black mottlings on the side of the neck.

Rüppell met with this species in Shoa, and Heuglin obtained several examples from the Upper White Nile, south of 9° N. lat., in February and March. Dr. Ragazzi also found it at Assakalel in Shoa, and Antinori noticed the species near Jerarudda in the Somali-Isa district. According to Dr. Reichenow, this species is widely distributed in East Africa, and he gives the names of many localities between Ugogo and Speke Gulf on the Victoria Nyanza.

70. BRADYORNIS PUMILUS, n. sp.

B. *similis* B. murino, *sed conspicue minor, et secundariis late fulvo marginatis. Long. tot.* 5·9 *poll., culm.* 0·6, *alæ* 3·2, *caudæ* 2·45, *tarsi* 0·85.

a. ♂ ad. Hargeisa, July 17, 1894.

b. Ad. Hargeisa, July 18, 1894.
c. Ad. The Haud, July 23, 1894.
d. ♀ ad.; *e.* ♂ imm. Schebeli, Sept. 9, 1894. Iris dark brown.

This bird is a small race of *B. murinus.* It is so much greyer than *B. pallidus* that it cannot be confounded with it, when once the two species are compared. There are some evidences of dusky streaks on the head, which give to the bird, at first sight, a resemblance to *Muscicapa grisola.*

71. MELÆNORNIS SCHISTACEA, n. sp.

M. similis M. atræ, *sed ubique schistacea, et remigibus intus albo marginatis distinguenda. Long. tot.* 8 *poll., culm.* 0·55, *alæ* 4, *caudæ* 4, *tarsi* 0·9.

a. Ad. Darro Mountains, Nov. 19, 1894.

The grey colour of this species easily distinguishes it from *M. atra,* but, in addition to that, the white quill-lining is very conspicuous.

Fam. SYLVIIDÆ.

72. PHYLLOSCOPUS TROCHILUS.

Phyllopseuste trochilus (L.); Heugl. Orn. N.O.-Afr. i. p. 298 (1869).

Phylloscopus trochilus, Seeb. Cat. B. Brit. Mus. v. p. 56 (1881); Sharpe, Ibis, 1892, p. 153; Reichen. Vög. Deutsch-Ost-Afr. p. 232 (1894).

a. Ad. Sheik Mahomet, Nov. 9, 1894.

Heuglin states that our Willow-Wren is a plentiful visitor to North-eastern Africa in winter, and he procured specimens at Khartoum and Berber at the end of August and the beginning of September. It goes south to Abyssinia, Kordofan, and the White Nile districts. Mr. Jackson shot one in Ukambani in March, and Dr. Reichenow records it from the Ronga River and Parè in winter.

73. EREMOMELA FLAVICRISSALIS. n. sp.

Similis E. flaviventri, *sed supra sordide schistacea, minime olivascens: subtus alba, hypochondriis imis, crisso et subcaudalibus pallide sulphureis distinguenda. Long. tot.* 3·5 *poll., culm.* 0·35, *alæ* 1·95, *caudæ* 0·95, *tarsi* 0·65.

a. Ad. Shebeli, Sept. 6, 1894. Iris yellow-ochre.

This little species is very similar to *E. flaviventris* and *E. griseoflava,* but is easily distinguished by the small amount of yellow on the underparts, which does not reach above the line of the thighs. The upper surface is of a darker slate-colour, very perceptibly so on comparison of specimens, and the tail-feathers have narrow white fringes, not ashy olive as in *E. flaviventris.*

74. CALAMONASTES SIMPLEX.

Erythropygia simplex (Cab.); Sharpe, Cat. B. Brit. Mus. vii. p. 74 (1883).

Thamnobia simplex, Salvad. Ann. Mus. Genov. (2) vi. p. 251 (1888).

Calomonastes simplex, Sharpe, Ibis, 1892, p. 154; Reichen. Vög. Deutsch-Ost-Afr. p. 225 (1894).

a. ♂ ad. Milmil, July 30, 1894.
b. ♂ ad. Okoto, Sept. 8, 1894. Iris reddish brown; legs purple-brown.
c. Ad. Sheik Husein, Oct. 2, 1894. Iris and legs light brown.

Mr. Lort Phillips has recently procured this species on the Goolis Mountains. Dr. Ragazzi obtained it at Soddè, in Shoa, in August. Mr. Jackson met with it at Turquel in January and at the River Voi, in Teita, in December. Dr. Reichenow also gives the Parè Mountains, Nguruman, and the Pangani River as localities for the species.

75. SYLVIELLA MICRURA.

Oligocercus rufescens (nec V.); Heugl. Orn. N.O.-Afr. i. p. 236 (1869).

Sylviella micrura (Rüpp.); Sharpe, Cat. B. Brit. Mus. vii. p. 154 (1883).

Sylvietta micrura, Salvad. Ann. Mus. Genov. (2) i. p. 145 (1888), vi. p. 251 (1888).

a. ♀ ad. Fehja, Nov. 23, 1894. Iris red; legs light brown.

According to Heuglin, this species is found singly or in pairs in North-eastern Africa, below 16° or 17° N. lat. On the African coast of the Red Sea it extends from Takah to Adel-land, and is found in Bogos-land and the warmer parts of Abyssinia, as well as in Southern Nubia, Kordofan, Senar, and on the Nile and its tributaries. Antinori procured it at Ambo-Karra in August and on the "Kolla" of Aigaber in Shoa in October, and Dr. Ragazzi at Cialalakà in June.

76. DRYODROMAS SMITHI.

Dryodromas smithi, Sharpe, Bull. B. O. C. iv. p. xxix.

a. ♂ ad. Shebeli, Sept. 4, 1894. Iris yellow-ochre; legs flesh-colour.
b, c. ♂ imm. Sheik Husein, Sept. 27, 1894. Iris light brown; eyelids yellow-ochre; legs light brown.

Differs in the greater amount of white on the outer tail-feathers, which have the outer web entirely white. The type-specimen has also distinct white edges to the wing-coverts and inner secondaries, but these are are not so plain in the two specimens from Sheik Husein, which are like *D. rufifrons*, but show much more white on the outer tail-feathers.

77. CISTICOLA DODSONI.

Cisticola dodsoni, Sharpe, Bull. B. O. Club, iv. p. xxix.

a. ♀ ad. The Haud, July 25, 1894.

78. CISTICOLA MARGINALIS.

Cisticola marginata, Heugl. Orn. N.O.-Afr. i. p. 248 (1869); Reichen. Vög. Deutsch-Ost-Afr. p. 223 (1894).

Cisticola marginalis (Heugl.); Sharpe, Cat. B. Brit. Mus. vii. p. 258 (1883).

a. ♂ ad. Sheik Mahomed, Nov. 4, 1894. Iris and legs light brown.

Heuglin obtained this species only on the Upper White Nile, the Gazelle River, and on the Lower Bahr-el-Djebel. Said by Dr. Reichenow to have been obtained at Tabóra in East Africa.

79. CISTICOLA SOMALICA, sp. n.

Similis C. hæsitatæ, *sed major et uropygio cinerascente concolore distinguenda. Long. tot.* 4·6 *poll., culm.* 0·6, *alæ* 2·15, *caudæ* 1·9, *tarsi* 0·8.

a. ♀ ad. Milmil, July 26, 1894.
b. ♂ ad. Ehrer, Aug. 16, 1894.

Although very similar to *C. hæsitata* of Socotra, this species is so much larger that it is impossible to believe that they can be identical. The rump also is uniform ashy, whereas it is distinctly mottled with darker centres in *C. hæsitata*. Another African species with which it seems to be related is *C. lugubris*, which it resembles in size, but is easily recognizable by its strongly streaked head and neck, the dark streaks being equally distinct on the sides of the face. It is also of a paler grey, and is further distinguished by the absence of rufous on the wing.

This species is evidently closely allied to *C. cinereola* of Salvadori (Ann. Mus. Genov. 2, vi. p. 254) from Farrè in Shoa, but is apparently distinguished by the strong shade of buff on the underparts and by the colour of the feet, which are dark yellowish brown, and could not be called pale horn-colour.

Fam. TURDIDÆ.

80. ERYTHROPYGIA LEUCOPTERA.

Aëdon leucoptera (Rüpp.); Heugl. Orn. N.O.-Afr. i. p. 279 (1869); Salvad. Ann. Mus. Genov. (2) i. p. 152 (1884).

Erythropygia leucoptera, Sharpe, Cat. B. Brit. Mus. vii. p. 79 (1883); Shelley, Ibis, 1885, p. 406; Salvad. Ann. Mus. Genov. (2) vi. p. 255 (1888).

a. ♂ ad. Dullaat, July 13, 1894.
b. ♀ ad. Hargeisa, July 21, 1894.
c. Ad. Shebeli, Sept. 6, 1894. Iris dark brown; base of under mandible yellow-ochre.

d. ♂ ad. Okoto, Sept. 7, 1894. Iris dark brown; base of under mandible yellow-ochre; legs light horn-colour.

e. ♂ ad. Sheik Husein, Sept. 24, 1894. Iris dark brown; base of under mandible yellow-ochre; legs light grey.

This is a Shoan species, and was not known to Heuglin from any other locality. It is rare in that country, according to Antinori, but Dr. Ragazzi appears to have met with it more plentifully near Ambokarra in May, and at the Farrè Falls in March and July.

81. COSSYPHA DONALDSONI.

Cossypha donaldsoni, Sharpe, Bull. B. O. Club, iv. p. xxviii (March, 1895).

a. ♀. Sheik Husein, Sept. 28, 1893. Iris dark brown.

This new species is closely allied to *Cossypha subrufescens* of Bocage, but the back is dark grey, as also are the wings, the quills not showing the light grey margins which are seen in *C. subrufescens*. This species is further distinguished by its uniform outer tail-feathers, which do not show the dusky edgings seen in the last-named species and in *C. heuglini* also.

82. CICHLADUSA GUTTATA.

Cichladusa guttata, Heugl. Orn. N.O.-Afr. i. p. 374 (1869); Sharpe, Cat. B. Brit. Mus. vii. p. 70 (1883); Oust. Bibl. École Hautes Études, xxxi. p. 6 (1886); Sharpe, Ibis, 1892, p. 160; Reichen. Vög. Deutsch-Ost-Afr. p. 227 (1894).

a. ♂ ad. Moodenner, Nov. 26, 1894. Iris reddish brown.

This species was found by Heuglin only at Aniob, in the Kidj Negro district, and on the banks of the Bahr-el-Djebel. Mr. Jackson met with it at Njemps, on Lake Barengo, in July, and it occurs at different places from Lake Naivascha to the coast-region of Bagamoyo, and the Pangani River.

83. GEOCICHLA SIMENSIS.

Turdus simensis (Rüpp.); Heugl. Orn. N.O.-Afr. i. p. 380 (1869).

Geocichla simensis, Seeb. Cat. B. Brit. Mus. v. p. 183 (1881).

Psophocichla simensis, Salvad. Ann. Mus. Genov. (2) i. p. 158 (1884), vi. p. 258 (1888).

a. ♀ ad. Sheik Mahomed, Nov. 1, 1894. Iris dark brown.

Heuglin states that this is one of the commonest species in the Abyssinian highlands, from the Pass of Taranta and Mensa to Western Amhara, south to the Gala country, but never found below 5000 feet.

Common in Shoa, at Licce and Fecheriè-Ghem, from October to February, according to Antinori. It was also found to be very common at Fallé in January by Dr. Pagazzi.

84. TURDUS ABYSSINICUS.

Turdus olivacinus, Bp.; Heugl. Orn. N.O.-Afr. i. p. 382 (1869).

Turdus abyssinicus, Gm.; Seeb. Cat. B. Brit. Mus. v. p. 228 (1881); Salvad. Ann. Mus. Genov. (2) i. p. 159 (1884), vi. p. 258 (1888).

a. ♀ juv. Sheik Mahomed, Nov. 4, 1894. Iris dark brown; legs orange; bill yellowish brown.

b. ♀ ad. Sheik Mahomed, Nov. 7, 1894. Iris dark brown; eyelids yellow-ochre: bill orange; legs bright yellow.

Distributed over the whole of Abyssinia, according to Heuglin, but only met with at an elevation of from 7000 to 11,000 feet above the sea. In Wolo-land he met with it up to 12,000 feet.

Antinori states that the species is not rare in Shoa, in Arramba and Ankober, nesting in February in the forests of this portion of the "Kolla." Dr. Ragazzi also found it to be very common in Shoa.

85. MONTICOLA SAXATILIS.

Monticola saxatilis (L.); Heugl. Orn. N.O.-Afr. i. p. 370 (1869); Seeb. Cat. B. Brit. Mus. v. p. 313 (1881); Salvad. Ann. Mus. Genov. (2) i. p. 160 (1884); Sharpe, Ibis, 1892, p. 161; Salvad. Mem. R. Accad. Torino, (2) xliv. p. 556 (1894).

a. ♀ ad. Webe Shebeli, Dec. 16, 1894. Iris dark brown.

Heuglin records the Rock-Thrush as a spring and autumn migrant in N.E. Africa, not rare in Egypt, Nubia, and Arabia. Some remain during the winter, others going south. He met with this species on the Gazelle River (7°–8° N. lat.) in November, near Aden in December and January, and also on the higher mountains of Abyssinia. It was procured by Antinori in Shoa, at Mahal-Uonz in March, and at Algaber in October. Mr. Jackson found it as far south as Ukambani, and, according to Dr. Reichenow, it has been procured at Bagamoyo, Igónda, and Kagéyi in German East Africa.

86. SAXICOLA ISABELLINA.

Saxicola isabellina, Rüpp.; Heugl. Orn. N.O.-Afr. i. p. 344 (1869); Seeb. Cat. B. Brit. Mus. v. p. 399 (1881); Shelley, Ibis, 1885, p. 405; Salvad. Ann. Mus. Genov. (2) i. p. 164 (1884), vi. p. 36 (1888); Sharpe, Ibis, 1892, p. 162; Reichen. Vög. Deutsch-Ost-Afr. p. 236 (1894).

a. ♂ ad. Ummayer, Dec. 3, 1894. Iris brown.

This is a very large specimen (wing 4·15), with a reddish-brown crown, and the rufous-brown on the rump strongly marked. I notice, however, a tendency in many individuals in our large series in the Museum to vary in these particulars, and I have therefore come to the conclusion that Dr. Smith's specimen is only a particularly fine one.

The Isabelline Wheatear, according to Heuglin, is a resident bird in Abyssinia, and breeds in Semien up to 10,000 feet. It is found singly, in autumn, winter, and spring, in Egypt, Arabia, and on the islands and coast of the Red Sea, as well as in Somaliland, Nubia, and Kordofan. Antinori procured a specimen at Daimbi, in Shoa, in November. Mr. Jackson found this Wheatear very plentiful in January in Turquel, at the foot of Mount Elgon, and it has been procured by Dr. Fischer on Lake Naiwascha, and near Kipini in Formosa Bay.

87. SAXICOLA ŒNANTHE.

Saxicola œnanthe (L.); Heugl. Orn. N.O.-Afr. i. p. 347 (1869); Seeb. Cat. B. Brit. Mus. v. p. 391 (1881); Oust. t. c. p. 7 (1886); Sharpe, Ibis, 1892, p. 162.

a. ♀ ad. Sheik Husein, Sept. 23, 1894. Iris dark brown.

Our European Wheatear is said by Heuglin to be a winter visitant to North-eastern Africa and Arabia, south as far as the lake districts of the Upper Nile. Mr. Jackson procured a specimen at Kitina, in January, and Dr. Reichenow records the species as a winter visitant to Igónda, Ugálla, Ussáre, and Kagéyi in German East Africa.

88. SAXICOLA PHILLIPSI.

Saxicola phillipsi, Shelley, Ibis, 1885, p. 404, pl. xii.; Salvad. t. c. p. 556 (1894).

a. ♂ ad. Hargeisa, July 16, 1894.

89. SAXICOLA SOMALICA, n. sp.

S. *similis* S. morioni, *cauda eodem modo notata, sed gula alba distinguenda. Long. tot.* 6·4 *poll., culm.* 0·5, *alæ* 3·7, *caudæ* 2·45, *tarsi* 1·85.

a. ♂ imm. [?]. Doda, Nov. 21, 1894. Iris brown.

After a careful comparison of examples of all the species of *Saxicola* in the British Museum, I have been unable to refer this specimen to any one of them. The bird is in winter plumage, and is in most respects like the winter plumage of *S. morio*. The black on the ear-coverts and on the sides of the neck is developing plainly, but the throat, which in the parallel plumage of *S. morio* is also black, is white in *S. somalica*; nor can I trace any sign of underlying black plumage, which is always observable in *S. morio*. I am therefore under the impression that the species is quite distinct from the last-mentioned bird.

90. MYRMECOCICHLA MELANURA.

Saxicola melanura (Temm.); Heugl. Orn. N.O.-Afr. i. p. 361 (1869).

Myrmecocichla melanura (Temm.); Seebohm, Cat. B. Brit. Mus. v. p. 361 (1881); Oust. Bibl. École Hautes Études, xxxi. art. 10, p. 7 (1886).

a, b. Ad. Daragoody, July 11, 1894.

These specimens agree with the series in the British Museum from Aden and Abyssinia; but these all differ from the form found in Palestine, which seems to me to be quite distinct, and which I have named *M. yerburyi* (Bull. B. O. C. iv. p. xxxvi).

Heuglin says that this species is found, mostly in pairs, from Arabia Petræa south to Aden, and in the mountain valleys between Berber and Suakin, in Central and Southern Nubia, and in the rocky districts near Massowa, on most of the islands of the Danakil coast, near Tedjura, and in the country of the Eisa Somalis.

91. PRATINCOLA ALBIFASCIATA.

Pratincola semitorquata, Heugl. Orn. N.O.-Afr. i. p. 342 (1869).

Pratincola albifasciata, Sharpe, Cat. B. Brit. Mus. iv. p. 198 (1879); Salvad. Ann. Mus. Genov. (2) i. p. 166 (1884), vi. p. 262 (1888).

a. ♂ ad. Sheik Mahomed, Nov. 7, 1894. Iris dark brown.

This species was found by Rüppell in the mountains of Semien in Abyssinia. Mr. Blanford procured it near Adigrat and again on Lake Ashangi, Antinori and Ragazzi in Shoa from September to January, and the latter naturalist at Kundi in June. Antinori says that it inhabits the high districts of 2000 or 3000 metres, but is also found in the "Kolla" of Mahal-Uonz, Ascaelna, and Let-Maratrà.

Fam. TIMELIIDÆ.

92. CRATEROPUS SMITHI.

Crateropus smithi, Sharpe, Bull. B. O. Club, iv. p. xli (1895).

C. *similis* C. hartlaubi *et uropygio albo, sed loris et regione periophthalmica albis, regione parotica clare cinerea, nec brunnea, et gutturis pectorisque plumis cinereis, nec brunneis, albido squamulatim marginatis. Long. tot.* 10·2 *poll., culm.* 0·8, *alæ* 4·15, *caudæ* 4·5, *tarsi* 1·3.

a. ♀ ad. Sheik Husein, Sept. 30, 1894. Iris bright red; legs grey.

b. ♂ ad. Darro Mountains, Nov. 18, 1894. Iris greyish brown; legs brown.

This species belongs to the white-rumped section of the genus *Crateropus*, and is allied to *C. hartlaubi*, but is very distinct from that species. The white lores and hoary face distinguish it at a glance, and the grey feathers of the throat and breast, with their white margins, are also a conspicuous feature. The flanks are strongly fulvescent, and the general aspect of the upper surface is darker than in *C. hartlaubi*, the tail especially being almost black.

93. ARGYA RUBIGINOSA.

Argya rubiginosa (Rüpp.); Heugl. Orn. N.O.-Afr. i. p. 390 (1869); Sharpe, Cat. B. Brit. Mus. vii. p. 391.

Argya heuglini, Sharpe; Oust. Bibl. École Hautes Études, xxxi. art. 10, p. 5 (1886).

a. ♂ ad. Shebeli, Aug. 27, 1894. Iris straw-yellow.

This I take to be the true *A. rubiginosa* of Rüppell. The bird usually called *A. rubiginosa* by African authorities is that which I have called *A. heuglini* (Cat. B. vii. p. 391), as the name of *rufescens* proposed for it had been preoccupied by Blyth. I had not noticed that Heuglin himself had discovered his mistake and in his 'Appendix' to the 'Ornithologie Nordost-Afrika's' (iv. p. cccxii) renamed the species *A. rufula*, which name has been adopted by Dr. Reichenow (Vög. Deutsch-Ost-Afr. p. 219), who unearthed Heuglin's identification. On looking over our series, however, I find that there are three species of these rufous-coloured *Argyæ*, which may be characterized as follows:—

a. Lores grey or dusky.
  a'. Larger; dark brown above; forehead dark grey, extending to beyond the line of the eyes; hind-neck and mantle also dark brown with dark shaft-lines quite distinct: wing 3·8 inches .... *rubiginosa.* (Shoa and Somali.)
  b'. Smaller; light brown above; a narrow frontal line of grey; hind-neck light brown, but the dark shaft-lines not distinct, except on the forehead: wing 3·35 inches .... *rufula.* (Equatorial Africa.)
b. Lores vinaceous rufous, like the sides of the face and the under surface of the body .... *saturata.* (E. Africa.)

Hence arises a curious confusion of synonymy. Heuglin duly noticed the difference between *A. rubiginosa* and *A. rufescens*, but as the latter name was preoccupied, I proposed to call it *A. heuglini*, but at the same time I described the bird from Zanzibar, which now proves to be distinct from *A. rufula* (i. e., *A. rufescens*, Heugl., *nec* Blyth).

The name of the Zanzibar bird will therefore be

ARGYA SATURATA, n. sp.

Argya rufula, auct., *ex* Africa Orientali (*nec* Heuglin).

Argya heuglini, Sharpe, Cat. vii. p. 391 (pt. descr. nec syn.).

We have now several specimens of *A. rufula*, Heugl., and of *A. saturata* in the Museum collection, and the rufous lores and sides of face in the latter species are very pronounced.

Fam. PYCNONOTIDÆ.

94. PYCNONOTUS DODSONI, n. sp.

P. *similis* P. layardi, *sed multo minor*, *nigredine capitis gutturisque valde definita*, *et rectricibus albo terminatis*, *pectore et abdomine pure albis*, *præpectore albo*, *plumis medialiter suturate brunneo notatis*, *quasi squamatis*, *et dorsi plumis medialiter nigricanti-brunneis squamulatim notatis distinguendus*. *Long. tot.* 6·5 *poll.*, *culm.* 0·6, *alæ* 3·25, *caudæ* 2·6, *tarsi* 0·75.

a. Ad. Sillul, Aug. 8, 1894. Iris black.
b. ♂ ad. Lammo, Aug. 12, 1894.
c. ♀ ad. Dada, Nov. 21, 1894. Iris brown.

Dr. Reichenow (Vög. Deutsch-Ost-Afr. p. 207) says that *Pycnonotus minor*, Heugl., has been procured at Itále in German East Africa, and I expected to find that the small Bulbul collected by Dr. Donaldson Smith would prove to be Heuglin's species, which is said to differ from *P. layardi* in having the head and throat blackish brown instead of black, and not sharply defined from the colour of the back and chest. The under surface of the body is also whiter.

The last-named character is the only one which is found in the Somali Bulbul. The black of the head and throat is as well defined as in *P. layardi*, and contrasts with the brown of the neck and lower throat. The feathers of the upper surface have blackish-brown centres, which give a mottled appearance to the back; and the fore-neck is white, with blackish centres to the feathers, giving a scaly appearance which is very strongly marked. The ends of the tail-feathers are also very conspicuously white.

95. PHYLLOSTROPHUS PAUPER, n. sp.

Similis P. strepitanti, *Reichen., sed brunneus, minime olivascens: uropygio rufescente et cauda saturate brunnea distinguendus. Long. tot.* 7·2 *poll., culm.* 0·65, *alæ* 3·0, *caudæ* 3·15, *tarsi* 0·85.

a. ♀ ad. Shebeli, Aug. 28, 1894. Iris red.

The brown tail and the absolute want of any olive shade in the plumage seems to distinguish this species from *P. strepitans*, of which the Museum possesses specimens from Nyassa-land, identified by Dr. Reichenow.

Fam. MUSCICAPIDÆ.

96. PACHYPRORA PUELLA.

Batis puella, Reichen. JB. Hamb. Wiss. Anst. x. p. 18 (1893); id. Vög. Deutsch-Ost-Afr. p. 150.

a. ♂ ad. Hargeisa, July 21, 1894.
b. ♂. Okoto, Sept. 8, 1894. Iris yellow; ring next to the pupil thin, reddish brown.

The difficulty of preserving these little Flycatchers renders it by no means easy to determine the extent of the white eyebrow encircling the head. It is very seldom that good skins of the small *Pachyproræ* are obtainable; and although the pair sent by Dr. Donaldson Smith are in good condition, I cannot definitely trace a complete band of white round the crown. In every other respect they seem to be true *P. orientalis*; but I think that the want of a definite eyebrow is a character of importance, and so I have referred them to *P. puella* of Reichenow, though the median throat-mark in the female is not so clearly defined as in Dr. Reichenow's figure (*op. cit.* fig. 69).

97. MUSCICAPA GRISOLA.

Muscicapa grisola, L.; Heugl. Orn. N.O.-Afr. i. p. 439 (1871); Sharpe, Cat. B. Brit. Mus. iv. p. 151 (1879).

a. ♂ ad. Sheik Husein, Sept. 28, 1894. Iris dark brown.

The Common Flycatcher visits Egypt in August and September, and is said by Heuglin to extend southwards to Nubia, Senar, and Abyssinia. In October he found it not rare on the Adel and Somali coasts, and at Aden in December. Neither Antinori nor Ragazzi appear to have met with the species in Shoa, nor did Mr. Jackson meet with it on his journey to Uganda; but in German East Africa the species has been detected in all kinds of localities from the coast to the Victoria Nyanza, so that there is not the slightest doubt that the species migrates throughout the whole country between the lakes and the coast-region.

98. PARISOMA BOEHMI.

Parisoma boehmi, Reichen. J. f. O. 1882, p. 200; id. Vög. Deutsch-Ost-Afr. p. 215 (1894).

a. ♂ ad. Hargeisa, July 16, 1894. Iris straw-colour.

This interesting species, which Dr. Reichenow considers to be a Tit, but which I think to be a Flycatcher, has not yet been found in British East Africa or in Shoa, but is recorded by Dr. Reichenow from Ugógo, Wembaere, Mpwápwa, Parè Mountains, and Masai-land. Its presence in Somali-land was therefore unexpected, but it doubtless occurs in the intervening region.

99. TERPSIPHONE CRISTATA.

Terpsiphone melanogastra (Swains.); Heugl. Orn. N.O.-Afr. i. p. 441 (1871).

Terpsiphone cristata, Sharpe, Cat. B. Brit. Mus. iv. p. 354 (1879); Salvad. Ann. Mus. Genov. (2) i. p. 124 (1884); Shelley, Ibis, 1885, p. 400; Salvad. Ann. Mus. Genov. (2) p. 234 (1888); Sharpe, Ibis, 1892, p. 504.

a. ♂ ad.; *b.* ♂ imm. Shebeli, Aug. 26, 1894. Iris brown; eyelids bright blue; legs and bill bluish grey.

c. ♂ juv. Sheik Husein, Sept. 19, 1894. Iris brown; legs grey.

d. ♂ imm. Darro Mountains, Nov. 18, 1894. Iris brown; bill, eyelids, and legs bright grey.

e. ♂ ad. ——?, Jan. 10, 1895. Iris brown; bill and legs bluish grey.

Heuglin says that the home of this Paradise Flycatcher extends from the Abyssinian coast-land in lat. 16°–17° south to the upper districts of the White Nile and its tributaries. In the wooded portions of Abyssinia it ascends to 8000 feet, and is plentiful in that country, as also in Senar and in Southern Kordofan, on the Sobat, Djur, and Gazelle Rivers, as well as on the Bahr-el-Djebel. Antinori considered the species to be resident, but Heuglin believes that it may be partly migratory, moving at certain seasons to the neighbourhood of the waters. Antinori collected a series of specimens in Shoa, from March to December; and as Dr. Ragazzi procured the species in February, it may be taken as a resident in Shoa throughout the year. Mr. Jackson met with it at Turquel in December, and also in the Teita district; but, curiously enough, the species is not included by Dr. Reichenow in his list of the birds of German East Africa, where *Terpsiphone emini* is recorded from Bukoba, and the South-African *T. perspicillata* is the predominant species.

Fam. HIRUNDINIDÆ.

100. HIRUNDO ÆTHIOPICA.

Hirundo albigularis (nec Strickl.); Heugl. Orn. N.O.-Afr. i. p. 153 (1869).

Hirundo æthiopica, Blanf.; Oust. Bibl. École Hautes Études, xxxi. p. 5 (1886); Sharpe, Cat. B. Brit. Mus. x. p. 146 (1885); Salvad. Ann. Mus. Genov. (2) vi. p. 230 (1888); Reichen. Vög. Deutsch-Ost-Afr. p. 146 (1894).

a. ♂ ad. Hargeisa, July 20, 1894.

b. ♀ ad.; *c.* ♂ juv. Luku, Sept. 17, 1894. Iris dark brown.

Occurs, according to Heuglin, all along the Nile below 20°–21° N. lat., and in Abyssinia up to 10,000 feet. On the Red Sea it is less common, but in Bogos-land it is migratory, arriving with the first summer rain and remaining till September. Antinori records it from the same country as arriving in May and leaving in August. Antinori appears never to have met with the species in Shoa, but Dr. Ragazzi procured a young bird at Gascià Mulu in July. It has not occurred in Mr. Jackson's collections, but is recorded by Dr. Reichenow from Bagamoyo.

Order PICIFORMES.

Fam. PICIDÆ.

101. THRIPIAS SCHOENSIS.

Picus schoensis, Rüpp.; Heugl. Orn. N.O.-Afr. i. p. 809 (1871).

Thripias schoensis, Hargitt, Cat. B. Brit. Mus. xviii. p. 308 (1890).

a. ♂ ad. Dada, Nov. 21, 1894. Iris dark red.

This species was discovered by Rüppell in Shoa, and was obtained by Heuglin in the woods on the Bongo and Wau Rivers. Antinori and the Italian naturalists who succeeded that great explorer in Shoa never met with the species. In Teita, Mr. Jackson obtained the southern form, *T. namaquus* (Sharpe, Ibis, 1891, p. 308), and it is this species which Dr. Reichenow records from Usegúha, Nguru, Aruscha, Ugógo, and Kakoma (Vög. Deutsch-Ost-Afr. p. 121).

102. DENDROPICUS HEMPRICHI.

Picus hemprichi, H. & E.; Heugl. Orn. N.O.-Afr. i. p. 804 (1871)

Dendropicus hemprichii, Shelley, Ibis, 1885, p. 393; Hargitt, Cat. B. Brit. Mus. xviii. p. 299 (1890); Salvad. t. c. p. 552 (1894: Webbe, Valley of Habir).

Ipoctonus hemprichii, Salvad. Ann. Mus. Genov. (2) vi. p. 211 (1888).

a. ♂ ad. Hargeisa, July 20, 1894.
b. ♀ ad. Tooloo. Nov. 24, 1894. Iris red; bill and legs grey.

Not rare, according to Heuglin, on the Abyssinian and Adel coasts, to Senar and Kordofan and on the Lower White Nile. In Central Abyssinia and Gala-land he found it up to 10,000 and 11,000 feet. Dr. Ragazzi met with the species at Cialalakà in Shoa in June, but it does not extend to the south, as it is wanting in Mr. Jackson's collections, and is not recorded from German East Africa by Dr. Reichenow.

103. CAMPOTHERA NUBICA.

Picus nubicus, Gm.; Heugl. Orn. N.O.-Afr. i. p. 811 (1871).

Campothera nubica, Shelley, Ibis, 1885, p. 393; Hargitt, Cat. B. Brit. Mus. xviii. p. 93 (1890); Salvad. t. c. p. 552 (1894: Mandera); Sharpe, Ibis, 1892, p. 307; Reichen. Vög. Deutsch-Ost-Afr. p. 121 (1894).

Stictopicus nubicus, Salvad. Ann. Mus. Genov. (2) i. p. 88 (1884), vi. p. 211 (1888).

a. ♀ imm. Hargeisa, July 18, 1894.
b. ♂ ad. Sassabanna, July 31, 1894. Iris red.
c. Ad. Shebeli, Aug. 26, 1894. Iris dirty grey; legs grey.
d. Ad. Shebeli, Aug. 29, 1894. Iris crimson; legs pale sage-green.

According to Heuglin, this Woodpecker is pretty common in Takah, South Nubia, Kordofan, Senar, Abyssinia, and in the Samhar district. It is resident. Antinori says that he never found the species in the highlands of Shoa; in the base of the "Kolla" it is rare, but is met with there, and in similar localities in Somali-land it is common. Dr. Ragazzi collected specimens at Dinghai-Meseghia in March, at Ambo-Karra in May, and at Daimbi in June; Mr. Jackson found the species on Mount Elgon, at 6000 feet, in February; and Dr. Reichenow records it from the Pangani River, Usarámo, Irangi, the eastern slope of Kilima-njaro, and Mpwápwa.

Order SCANSORES.

Fam. INDICATORIDÆ.

104. INDICATOR INDICATOR.

Indicator sparmannii, Stephens; Heugl. Orn. N.O.-Afr. i. p. 767 (1871); Salvad. Ann. Mus. Genov. (2) i. p. 90 (1884).

Indicator indicator (Gm.); Shelley, Cat. B. Brit. Mus. xix. p. 5 (1891); Sharpe, Ibis, 1892, p. 308; Reichen. Vög. Deutsch-Ost-Afr. p. 112 (1894).

a. ♀ imm. Sassabanna, July 31, 1894.
b. ♂ ad. Stonybrook, Aug. 19, 1894. Iris light brown.
c. ♀ ad. Shebeli, Aug. 29, 1894.

Found by Heuglin in the Abyssinian lowlands and the Bogos district. Antinori procured the species at Ambo-Karra in Shoa in March, Mr. Jackson in the Ukanbani country in February, and Dr. Reichenow records it from the Pangani River, Kakoma, Igónda, Ussure, Irangi, and Ugalla.

Fam. CAPITONIDÆ.

105. TRACHYPHONUS SHELLEYI.

Trachyphonus erythrocephalus (nec Cab.), Shelley, Ibis, 1885, p. 394 (Somali plateau); Salvad. Mem. R. Accad. Torino, (2) xliv. p. 551 (1894).

a. ♀ ad. Milmil, July 26, 1894.
b. ♂ ad. Darro Mountains, Nov. 19, 1894. Iris brown; bill pale reddish brown.

Compared with the type this bird is much larger. It measures total length 8·2 inches, culmen 1·0, wing 3·5, tail 3·1. In *T. shelleyi* the culmen is 0·85, wing 3·1, tail 2·8.

The female appears to differ from the female of *T. erythrocephalus* in having the base of the forehead sulphur-yellow continued into a broad eyebrow, and in having more sulphur-yellow on the fore part of the cheeks and throat.

106. TRACHYPHONUS UROPYGIALIS.

Trachyphonus uropygialis, Salvad. Mem. Accad. Tor. (2) xliv. p. 551 (1894).

a. ♀ ad. Dabulli, Sept. 16, 1894. Iris dark brown; cere black; bill greyish horn-colour; legs grey.

Count Salvadori has separated this species on account of the lateral upper tail-coverts being crimson; but all our six specimens of *T. boehmi* in the British Museum show this peculiarity, and I very much doubt if *T. uropygialis* is distinct. The Somali bird has, however, the rump sulphur-yellow, with minute spots of black, which are not seen in *T. boehmi*, but are apparent in *T. arnaudi*.

107. TRICHOLÆMA STIGMATOTHORAX.

Tricholæma stigmatothorax, Cab.; Shelley, Ibis, 1885, p. 394; id. Cat. B. Brit. Mus. xix. p. 29, pl. ii. fig. 1 (1821); Sharpe, Ibis, 1892, p. 509; Reichen. Vög. Deutsch-Ost-Afr. p. 116 (1894).

a. Ad. Sillul, Aug. 6, 1894. Iris black; legs dark slate-colour.

This species was not known to Heuglin or the Italian explorers of Shoa, but was found by Mr. Jackson in the Teita country, and is recorded by Dr. Reichenow from the Pangani and Ronga Rivers, Nguruman, Aruscha, and the eastern slope of Kilima-njaro.

Order PSITTACIFORMES.

Fam. PSITTACIDÆ.

108. PŒOCEPHALUS RUFIVENTRIS.

Pionias rufiventris (Rüpp.); Heugl. Orn. N.O.-Afr. i. pt. 2, p. 741.

Pœocephalus rufiventris, Salvad. Ann. Mus. Genov. (2) i. p. 78 (1884), vi. p. 207 (1888); id. Cat. B. Brit. Mus. xx. p. 372 (1891); Shelley, Ibis, 1885, p. 393 (Somali tableland); Sharpe, Ibis, 1891, p. 311; Salvad. Mem. R. Accad. Torino, (2) xliv. p. 551 (1894: S. of Mt. Goolis); Reichen. Vög. Deutsch-Ost-Afr. p. 99 (1894).

a. ♂. Boholgarshan, July 15, 1894.
b, c. ♂ ♀. Hargeisa, July 17, 1894.

According to Heuglin, this Parrot lives in flocks in the warmer parts of Shoa, for instance on the Eifat, as well as on the Somali plateau southwards from 6° S. lat. It apparently comes to the Upper White Nile. It is not a highland species, and scarcely extends beyond 4000 to 6000 feet.

In Shoa, Antinori says that it is a bird of the plains and scarcely visits the elevated "Kolla." Mr. Jackson procured the species in the Teita district, and Dr. Reichenow records it from the Pangani and Ronga Rivers, at Parè and in Masai-land.

Order COCCYGES.

Fam. CUCULIDÆ.

109. CUCULUS CANORUS.

Cuculus canorus, L.; Heugl. Orn. N.O.-Afr. i. p. 779 (1871); Salvad. Ann. Mus. Genov. (2) i. p. 93 (1884); Shelley, Cat. B. Brit. Mus. xix. p. 245 (1891); Reichen. Vög. Deutsch-Ost-Afr. p. 110 (1894).

a. Juv. Sheik Mahomed, Nov. 7, 1894. Iris brown; eyelids, legs, and corners of mouth yellow; bill black, shading through green to yellow at the corners of the mouth.

Heuglin records the Common Cuckoo as a plentiful migrant throughout N.E. Africa, passing in spring and autumn. From March to the early part of May it comes to Egypt from the south, and in August is on its way back again, and he obtained a specimen in Bogos-land at the end of July. The species is not, however, often met with during its migrations, and Antinori only obtained a single young bird in Shoa in September, and Dr. Fischer in Aruscha. It has not been procured by Mr. Jackson.

110. CENTROPUS SUPERCILIOSUS.

Centropus superciliosus, H. & E.; Heugl. Orn. N.O.-Afr. i. p. 797 (1871); Salvad. Ann. Mus. Genov. (2) i. p. 96 (1884), vi.

p. 215 (1888); Shelley, Ibis, 1885, p. 400; id. Cat. B. Brit. Mus. xix. p. 363 (1891); Reichen. Vög. Deutsch-Ost-Afr. i. p. 107, fig. 40 (1894).

a. ♂ ad. Tooloo, Nov. 25, 1894. Iris crimson; legs grey; bill black.
b. ♀ ad. Gelaydee, Jan. 13, 1895.

A resident species in N.E. Africa, according to Heuglin, living in pairs in Southern Arabia and the Abyssinian coast-lands to the Anseba Valley, on the Takazié River and on the Blue Nile, in Southern Nubia to the province of Dongola, and in Kordofan. It is common in the "Kolla" country of Shoa, according to Antinori, and Dr. Reichenow records the species from numerous localities from the Pangani River to Bukoba.

Fam. MUSOPHAGIDÆ.

111. SCHIZORHIS LEUCOGASTER.

Schizorhis leucogaster (Rüpp.): Heugl. Orn. N.O.-Afr. i. p. 707 (1871); Shelley, Ibis, 1885, p. 400; Salvad. Ann. Mus. Genov. (2) i. p. 90 (1884), vi. p. 216 (1888); Shelley, Cat. B. Brit. Mus. xix. p. 452 (1891); Sharpe, Ibis, 1892, p. 314; Salvad. Mem. R. Accad. Torino, (2) xliv. p. 552 (1894: Odeuin, Webbe R.); Reichen. Vög. Deutsch-Ost-Afr. p. 102 (1894).

a. ♂ ad. Milmil, July 27, 1894.
b. ♀ ad. Okoto, Sept. 8, 1894. Iris dark brown; bill yellowish green, base of ridge yellow-ochre.
c. Ad. Lookoo, Sept. 18, 1894.
d. ♂ ad. Hanouttoo, Nov. 20, 1894. Iris brown; bill and legs black.

The "Ahia," writes Heuglin, lives in small families in the warmer valleys of Southern Shoa, where high trees are scattered about, on the Hawasch River, and on the plateau of Somali-land. It is undoubtedly resident. Antinori says that it was common in the woods of Ambo-Karra in Shoa. Mr. Jackson met with it at Turquel and also in the Teita district, and Dr. Reichenow records it from Ussagara, Ugógo, Kakoma, Lake Jipi, Mpwápwa, Aruscha, and Masai-land.

112. TURACUS DONALDSONI. (Plate XXVIII.)

Turacus donaldsoni, Sharpe, Bull. B. O. C. iv. p. xxxii (1895).

a. ♂ ad. Meo, Oct. 25, 1894.
b. ♀ ad. Darro Mountains, Nov. 19, 1894. Iris brown; eye-wattle and bill vermilion.

This species bears considerable similarity to *Turacus leucotis*, in the possession of a white spot in front of the eye and another on the side of the neck; the colouring of the rest of the body is also the same, but that of the crest is quite different, and, according to Captain Shelley's arrangement of the genus *Turacus* (Cat. B. xix.

p. 436), *T. donaldsoni* would come near the red-tipped species, *T. meriani* and *T. fischeri*. Both of these species, however, have a band of white below the eye, which is absent in *T. donaldsoni*, while the white spot on the sides of the neck, the leaden-blue colour of the back, and the patch of light crimson which forms the crest are characteristics of the new species.

Order CORACIIFORMES.

Fam. Coraciidæ.

113. Coracias lorti.

Coracias lorti, Shelley, Ibis, 1885, p. 399; Salvad. Ann. Mus. Gen. (2) vi. p. 224 (1888); Sharpe, Cat. B. Brit. Mus. xvii. p. 20 (1892); Salvad. Mem. R. Accad. Torino, (2) xliv. p. 554 (1894: Webbe and Juba Rivers).

a. ♂ ad. Hargeisa, July 21, 1894.
b. ♀ ad. Stonybrook, Ehrer River, Aug. 19, 1894.
c. ♂ ad. Sheik Husein, Sept. 19, 1894. Iris brown; legs yellow-ochre.
d. ♀ ad. Dada, Nov. 21, 1894.

114. Coracias nævius.

Coracias pilosa, Lath.; Heugl. Orn. N.O-Afr. i. p. 172 (1869).

Coracias nævius, Daud.; Shelley, Ibis, 1885, p. 399; Salvad. Ann. Mus. Genov. (2) i. p. 115, vi. p. 223 (1888); Sharpe, Cat. B. Brit. Mus. xvii. p. 24 (1892); id. Ibis, 1892, p. 316; Salvad. Mem. R. Accad. Torino, (2) xliv. p. 554 (1894: Aduma); Reichen. Vög. Deutsch-Ost-Afr. p. 124 (1894).

a. ♂ ad. Dabulli, Sept. 16, 1894. Iris brown; eyelid yellowish brown; legs dirty yellow-ochre.

Found, according to Heuglin, on the coast-lands of Abyssinia, in Kordofan, and on the White Nile. From January to August Antinori met with it at Let-Marafia in Shoa, and he says that isolated individuals are met with in the low and middle "Kolla," but it is a bird which loves open country. Mr. Jackson procured the species at Machako's, and Dr. Reichenow gives two localities, Assandaui and Igonda.

Fam. Alcedinidæ.

115. Ceryle rudis.

Ceryle rudis (Linn.); Heugl. Orn. N.O.-Afr. i. p. 184 (1869); Salvad. Ann. Mus. Genov. (2) i. p. 112 (1884), vi. p. 222 (1888); Oust. Bibl. Ecole Hautes Etudes, xxxi. art. no. 10, p. 3 (1886); Sharpe, Cat. B. Brit. Mus. xviii. p. 109 (1892); Reichen. Vög. Deutsch-Ost-Afr. p. 130 (1894).

a. ♂ ad. Bainhou, Jan. 10, 1894. Iris brown.

Heuglin states that the Pied Kingfisher is found from the

Mediterranean coast of Egypt, throughout the whole of the Nile region and on its tributaries, the Kosanga and the Djar Rivers, but becomes rarer on the Upper White Nile than in Egypt and Nubia. It is also found along the Red Sea. In Shoa, Antinori notes the species from the lower and middle "Kolla" country; and according to Dr. Reichenow it has been met with at Usegúha, Bagamoyo, Ugalla, Kakoma, Pangani, Kagéhi, and the Simiu River, in German East Africa.

116. ISPIDINA PICTA.

Alcedo picta (Bodd.); Heugl. Orn. N.O.-Afr. i. p. 183 (1869); Salvad. Ann. Mus. Genov. (2) i. p. 113 (1884), vi. p. 223 (1888).

Ispidina picta, Sharpe, Cat. B. Brit. Mus. xvii. p. 191 (1892); id. Ibis, 1892, p. 316; Reichen. Vög. Deutsch-Ost-Afr. p. 133 (1894).

a. ♀ ad. Mount Kuldush, Dec. 18, 1894. Bill and legs orange-red; iris brown.

Nowhere common in N.E. Africa, according to Heuglin's notes; mostly seen in the wood-region up to 7000 feet. He found it in Bogos-land, in Central Abyssinia, and in the steppes of East Senar, Fazogl, &c.

It is not common in Shoa; Mr. Jackson only met with it once, at Kasamoja, and Dr. Reichenow has only four localities for the species—Dar-es-Salaam, Usegúha, Nguruman, and the Simiu River.

117. HALCYON SEMICÆRULEUS.

Dacelo semicærulea (Forsk.); Heugl. Orn. N.O.-Afr. i. p. 190 (1869).

Halcyon semicærulea, Salvad. Ann. Mus. Genov. (2) i. p. 113 (1884), vi. p. 223 (1888); Shelley, Ibis, 1885, p. 395; Oust. t. c. p. 4; Sharpe, Cat. B. Brit. Mus. xvii. p. 232 (1892); id. Ibis, 1892, p. 317; Salvad. Mem. R. Accad. Torino, (2) xliv. p. 553 (1894: Webbe River); Reichen. Vög. Deutsch-Ost-Afr. p. 132 (1894).

a. ♂ ad.; *b*. Ad. Gelaydee, Jan. 13, 1895. Bill vermilion; legs dark red; iris brown.

This Kingfisher extends all over the warmer parts of N.E. Africa, and Heuglin gives its northern limit as 16° N. lat. In October he met with it on the Adail and Somali coast, in Abyssinia to 8000 feet, north to Bogos-land and Takah, on the Blue and White Niles, westward to the Djur district. In Shoa it is said by Antinori to be common in all the woods along the streams of the "Kolla"; Mr. Jackson procured it in the Sük country, and Dr. Reichenow gives many localities from Bagamoyo to Bussissi.

118. HALCYON CHELICUTENSIS.

Dacelo tschelicutensis (Stanl.); Heugl. Orn. N.O.-Afr. i. p. 192 (1869).

Halcyon chelicutensis, Oust. Bibl. École Hautes Études, xxxi.

art. no. 10, p. 3 (1886); Sharpe, Cat. B. Brit. Mus. xvii. p. 239 (1892).

Halcyon chelicuti, Reichen. Vög. Deutsch-Ost-Afr. p. 131 (1894).

a. ♂ ad. Milmil, July 26, 1894.

Found along the Abyssinian coast-region, and through Abyssinia excepting on the high mountains, and Heuglin also says that he met with the species in Takah, Galabat, and Senar. It has not been met with in Shoa by the Italian travellers, nor by Mr. Jackson in any of his expeditions to Uganda; and Dr. Reichenow only records the species from Kakoma, Ussandani, and Wembere.

Fam. BUCEROTIDÆ.

119. LOPHOCEROS HEMPRICHI.

Buceros hemprichii, Ehr.; Heugl. Orn. N.O.-Afr. i. p. 721 (1869).

Lophoceros hemprichii, Salvad. Ann. Mus. Genov. (2) vi. p. 218 (1888); Ogilvie-Grant, Cat. B. Brit. Mus. xvii. p. 405 (1892).

Tockus hemprichii, Salvad. Ann. Mus. Genov. (2) i. p. 103 (1884).

a. ♂ ad. Darro Mountains, Nov. 17, 1894. Iris yellowish brown; bill brownish crimson, the under mandible brighter.

In Abyssinia Heuglin states that this species is found in the Dega region from 5000 to 11,000 feet, and says that, if his recollection is correct, he has also received it from the Upper White Nile and from Southern Kordofan. He also records it from Tigré and Ambara, eastwards to the Taranta Pass and Mensa. In Shoa, Antinori says the species is rare in Ambo-Karra, common on the Waina Dega and the Dega. Dr. Ragazzi found it plentiful in the parts of Shoa he visited, but it does not occur in German East Africa.

120. LOPHOCEROS MEDIANUS, n. sp.

Lophoceros erythrorhynchus?, Salvad. Mem. R. Accad. Torino, (2) xliv. p. 553.

a. Dabulli, Sept. 16, 1894. Iris dark brown; orbits white, shaded with pinkish grey; bill red, the base white, merging into black on the lower mandible.

I have compared this species with *L. damarensis*, Shelley, and it is so very much smaller than that bird that it cannot be considered identical with it. It has the face white and the broad eyebrow as in *L. damarensis*, but the grey of the crown comes down almost to the base of the bill, so that the forehead is not so pure white as in *L. damarensis*. This character, however, may be variable, but the small size of the Dabulli bird seems to deserve recognition. There is a little shade of grey on the ear-coverts, showing an approach to *L. erythrorhynchus*; and it is evidently the same species as that procured by Prince Ruspoli on his expedition, on which Count Salvadori has made some apposite remarks.

The measurements are as follows:—

	Total length.	Culmen.	Wing.	Tail.	Tarsus.
L. damarensis (type) ..	19·0	3·45	7·7	8·0	1·7
,, ,, ..	18·5	3·1	7·8	7·7	1·6
L. medianus	15·5	2·6	6·9	7·5	1·5

121. Lophoceros flavirostris.

Buceros flavirostris, Rupp.; Heugl. Orn. N.O.-Afr. i. p. 725 (1871).

Tockus flavirostris, Salvad. Ann. Mus. Genov. (2) i. p. 104 (1884), vi. p. 219 (1888).

Lophoceros flavirostris, Ogilvie-Grant, Cat. B. Brit. Mus. xvii. p. 412 (1892); Salvad. Mem. R. Accad. Torino, (2) xliv. p. 554 (1894: Webbe Valley); Reichen. Vög. Deutsch-Ost-Afr. p. 128 (1894).

a. ♂ ad. Smith River, Sept. 11, 1894. Irides yellow; orbits black; throat light Indian-red, bluish at the corner of the under mandible; bill bright yellow-ochre, darker at base.

This specimen is true *L. flavirostris*, and not *L. somaliensis* of Reichenow (*cf.* Salvadori, *l. c.*).

According to Heuglin, this Hornbill lives in pairs and families in the hot valleys of Schoholand, frequenting high trees and the *Nabag*-bushes, which are found in the Bay of Adulis and Samhar, as well as near Moiet Schahadi below Mekulu, but not in the coast-districts proper. It is apparently to be found along the mountain fringes of the Danakil and Adel coasts to Somali-land. Antinori states that it is common on the plains and on the lower " Kolla " of Shoa, but does not ascend to any height. It has occurred at Ndi in the Teita district, to the east of Kilima-njaro, but was not in Mr. Jackson's collections.

122. Lophoceros sibbensis.

Lophoceros sibbensis, Sharpe, Bull. B. O. C. iv. p. xxxii (1895).

a. ♀ ad. Sibbe, Aug. 3, 1894. Iris brown; feet black, the soles yellowish white; bare skin of neck light blue, Indian-red next the bill.

123. Bucorax abyssinicus.

Tmetoceros habessinicus (Bodd.); Heugl. Orn. N.O.-Afr. i. p. 731 (1871: pt.).

Bucorvus abyssinicus, Salvad. Ann. Mus. Genov. (2) i. p. 101 (1884), vi. p. 217 (1888).

Bucorax abyssinicus, Ogilvie-Grant, Cat. B. Brit. Mus. xvii. p. 349 (1892); Sharpe, Ibis, 1892, p. 317.

a. Ad. Sheik Mahomed, Nov. 5, 1894. Iris dark brown; neck-pouch and orbits bluish grey; patch on base of bill dull red.

Heuglin gives a wide distribution for this species in North-eastern Africa. He did not find it in Samhar, but in the neighbouring mountains of Bogos and Habab, as well as in Takah, throughout the whole of Abyssinia south to Shoa, in Fazogl, Senar, Kordofan, and in the district of the White Nile westwards to the Kosanga River. Antinori collected a number of specimens in Shoa, and Mr. Jackson met with the species on the Turquel River; but in East Africa, according to Dr. Reichenow, it is replaced by *B. cafer*.

Fam. UPUPIDÆ.

124. UPUPA SOMALENSIS.

Upupa epops senegalensis (nec Sw.); Shelley, Ibis, 1885, p. 397.

Upupa somalensis, Salvin, Cat. B. Brit. Mus. xvi. p. 13, pl. i. (1892).

a. ♀ ad. Hargeisa, July 21, 1894.

125. IRRISOR ERYTHRORHYNCHUS.

Irrisor erythrorhynchus (Lath.); Heugl. Orn. N.O.-Afr. i. p. 214 (1869); Salvad. Ann. Mus. Genov. (2) i. p. 107 (1884), vi. p. 220 (1888); Shelley, Ibis, 1885, p. 395; Salvin, Cat. B. Brit. Mus. xvi. p. 19 (1892); Reichen. Vög. Deutsch-Ost-Afr. p. 138 (1894).

a. ♂ ad. Shebeli, Aug. 26, 1894. Iris brown; legs coral-red.

c. Ad. Sheik Mahomed, Oct. 28, 1894.

b. ♀ ad. Shebeli, Sept. 3, 1894. Iris brown; legs bright coral-red; base of lower mandible red.

An inhabitant of the wooded country of N.E. Africa, and met with by Heuglin in Takah, Abyssinia, Senar, Kordofan, and in the White Nile districts, westwards to the Kosanga, as well as on the Abyssinian coast-land, ascending the mountains to 1000 feet. Antinori says that the species was common but local at Daimbi in Shoa. It has not occurred to Mr. Jackson in the interior, but Dr. Reichenow gives a number of localities for it in German East Africa—Dar-es-Salaam, Pangani River, Ugogo, Mpwapwa, &c.

126. RHINOPOMASTUS MINOR.

Irrisor minor (Rüpp.); Heugl. Orn. N.O.-Afr. i. p. 218 (1869); Shelley, Ibis, 1885, p. 397.

Rhinopomastus minor, Salvad. Ann. Mus. Genov. (2) i. p. 263 (1884), vi. p. 220 (1888); Salvin, Cat. B. Brit. Mus. xvi. p. 26 (1892); Salvad. Mem. R. Accad. Torino, (2) xliv. p. 553 (1894: River Adadle and Mt. Goolis).

a. ♂ ad. The Haud, July 22, 1894.

b. ♂ ad. Milmil, July 30, 1894. Bill orange.

There seems to be some mistake in the 'Key' to the genus *Rhinopomastus* given in the 'Catalogue' (p. 24), as *R. minor* is placed with *R. cyanomelas* in the section with sub-terminal white spots on the tail. As a matter of fact *R. minor* has the tail uniform like *R. cabanisi*, which, however, is easily recognized by the absence of the white band on the quills.

Rüppell discovered this Wood-Hoopoe in Shoa, and Antinori met with the species in the country of the Adda Galas, but not in Shoa proper. It has, however, been obtained at Soddé by Dr. Ragazzi. To the south its place appears to be taken by *R. cabanisi*.

Fam. MEROPIDÆ.

127. MEROPS APIASTER.

Merops apiaster, Linn.; Heugl. Orn. N.O.-Afr. i. p. 196 (1869); Salvad. Ann. Mus. Genov. (2) i. p. 107 (1884); Sharpe, Cat. B. Brit. Mus. xvii. p. 63 (1892); id. Ibis, 1892, p. 319; Reichen. Vög. Deutsch-Ostafr. p. 135 (1894).

a. ♂ ad. Luku, Sept. 18, 1894. Iris reddish brown.

A migrant throughout N.E. Africa, according to Heuglin, from the end of March to the early part of May, and from August to October, mostly in companies. In Arabia Petræa and in Central Egypt he believes that it breeds in May. Antinori met with it in Shoa, passing south in August, and also obtained one specimen in October. It was found by Mr. Jackson in Ukambani and also in Sotik. Dr. Reichenow records it from Dar-es-Salaam, Kakoma, Wualaba, Ugalla, and Igonda.

128. MEROPS NUBICUS.

Merops nubicus, Gm.; Heugl. Orn. N.O.-Afr. i. p. 199 (1869); Salvad. Ann. Mus. Genov. (2) i. p. 108 (1884); Shelley, Ibis, 1885, p. 397; Oust. Bibl. École Hautes Études, xxxi. no. 10, p. 4 (1886); Sharpe, Cat. B. Brit. Mus. xvii. p. 85 (1892); Salvad. Mem. R. Accad. Torino, (2) xliv. p. 552 (1894); Reichen. Vög. Deutsch-Ost-Afr. p. 135 (1894).

a, *b*. ♀ ad. Tooloo, Jan. 13, 1895. Iris dark red.

Heuglin says that this species is found in the warmer parts of Abyssinia, ascending to 6000 or 7000 feet He found it common in Takah, Senar, Kordofan, and along the White Nile, sometimes occurring in flocks of thousands. It breeds at the commencement of the summer rainy season, in the Negro-lands of the Upper Nile in March and April, and in the Eastern Sudan between June and August. Antinori says that in Shoa it is a migrant, passing in small flocks: he obtained it from September to January. Dr. Reichenow records the species from the Pangani River.

129. MELITTOPHAGUS CYANOSTICTUS.

Melittophagus pusillus cyanostictus, Shelley, Ibis, 1885, p. 398.

Merops cyanostictus (Cab.); Oust. Bibl. École Hautes Études, xxxi. art. 10, p. 4 (1886).

Melittophagus cyanostictus, Salvad. Ann. Mus. Genov. (2) i. p. 110 (1884), vi. p. 221 (1888); Sharpe, Ibis, 1892, p. 319; id. Cat. B. Brit. Mus. xvii. p. 48, pl. i. fig. 3 (1892); Reichen. Vög. Deutsch-

Ost-Afr. p. 136 (1894); Salvad. Mem. R. Accad. Torino, (2) xliv. (1894: Hento Valley, Webbe River).

a. ♀ ad. Near Berbera, July 12, 1894.
b. ♂ ad.; *c.* Ad. Shebeli, Sept. 5, 1894. Iris bright red.

In Shoa, Antinori states, this species is common throughout the year in the lower "Kolla," but does not ascend to any height. Mr. Jackson procured it on Mt. Elgon, and Dr. Reichenow gives a number of localities for the species in German East Africa.

130. MELITTOPHAGUS REVOILII.

Merops (*Melittophagus*) *revoilii*, Oust. in Revoil's Faun. et Flor. Çomalis, Ois. p. 5, pl. i. (1882); id. Bibl. École Hautes Études, xxxi. art. 10, p. 4 (1886).

Melittophagus revoilii, Shelley, Ibis, 1885, p. 398; Sharpe, Cat. B. Brit. Mus. xvii. p. 54 (1892).

a. ♂ ad. Hargeisa, July 15, 1894.
b. Ad. The Haud, July 25, 1894.

This species is apparently peculiar to Somali-land.

Fam. COLIIDÆ.

131. COLIUS LEUCOTIS.

Colius leucotis, Rüpp.; Heugl. Orn. N.O.-Afr. i. p. 710 (1871); Salvad. Ann. Mus. Genov. (2) i. p. 100 (1884), vi. p. 217 (1888); Oust. Bibl. École Hautes Études, xxxi. art. no. 10, p. 3 (1886); Sharpe, Cat. B. Brit. Mus. xvii. p. 341, pl. xii. fig. 1 (1892); Salvad. t. c. p. 552 (1894: Habir Valley).

a. ♂ ad. Sheik Husein, Sept. 23, 1894. Iris bluish grey; orbits grey; legs coral-red.
b. Ad. Sheik Husein, Sept. 27, 1894. Iris bluish grey; legs coral-red.

A resident species, according to Heuglin, in the countries of the Beni-Amer, Bogos-land, and the whole of Abyssinia and the Gala countries; less common in Southern Senar, Fazogl, on the Sobat and Upper White Nile to the Gazelle River. Antinori found it in Shoa in small companies ascending to the higher elevations and breeding; but it is not in Mr. Jackson's collections, nor mentioned in Dr. Reichenow's work.

132. COLIUS MACRURUS.

Colius macrourus (Linn.); Heugl. Orn. N.O.-Afr. i. p. 712 (1871).

Colius macrurus, Oust. Bibl. École Hautes Études, xxxi. art. 10, p. 3 (1886); Sharpe, Cat. B. Brit. Mus. xvii. p. 345 (1892); Reichen. Vög. Deutsch-Ost-Afr. p. 105 (1894).

a, b. ♂ ♀ ad. Boholgarshan, July 15, 1894. Iris and cere crimson.

This Coly is found, according to Heuglin, in Southern Nubia and Takah, from about 17° N. lat. southwards. It occurs in Bogos-land, the lowlands of Abyssinia, extending up to 7000 feet, Senar and Kordofan, but does not go far south along the White Nile. It has not been recorded from Shoa, but Dr. Reichenow gives the Pangani River as a single locality for the species in East Africa.

Fam. CAPRIMULGIDÆ.

133. CAPRIMULGUS INORNATUS.

Caprimulgus inornatus, Heugl. Orn. N.O.-Afr. i. p. 129 (1869); Hartert, Cat. B. Brit. Mus. xvi. p. 556 (1892); Sharpe, Ibis, 1892, p. 322; Reichen. Vög. Deutsch-Ost-Afr. p. 139 (1894).

a. ♂ ad. Zeila, June 30, 1894.

Heuglin found this Goatsucker not uncommon during the rainy season in Bogos-land, where also Messrs. Blanford and Jesse collected it. Heuglin also procured a specimen near Tedjura on the Adail coast. Mr. Jackson met with the species at Makarunga, and Dr. Reichenow records it from Kigonge in Usaramo.

134. CAPRIMULGUS DONALDSONI.

Caprimulgus donaldsoni, Sharpe, Bull. B. O. Club, iv. p. xxix (1895).

a. Ad. Hargeisa, July 18, 1894.

This fine species of Goatsucker with its long rictal bristles, its red collar round the hind-neck, mottled with golden-buff spots, with a similar collar across the fore-neck, is very distinct from all other African Goatsuckers, and Mr. Hartert pronounces it unquestionably a new species.

Fam. CYPSELIDÆ.

135. TACHORNIS PARVA.

Cypselus parvus, Licht.; Heugl. Orn. N.O.-Afr. i. p. 144 (1869).

Tachornis parva (Licht.); Hartert, Cat. B. Brit. Mus. xvi. p. 463.

a. ♀ ad. Shebeli, Aug. 28, 1894.

Heuglin says that this Swift is resident in Southern Egypt, in Nubia, and along the White and Blue Niles, becoming rarer in the Gazelle River district. He believes that he saw it also on the Arabian coast and the Dahlak Islands, but not in the Abyssinian Mountains.

Order STRIGES.

Fam. BUBONIDÆ.

136. BUBO LACTEUS.

Bubo lacteus (T.); Heugl. Orn. N.O.-Afr. i. p. 112 (1869); Sharpe, Cat. B. Brit. Mus. ii. p. 33 (1875); Shelley, Ibis, 1885, p. 392 (Ogadayn); Salvad. Ann. Mus. Genov. (2) vi. p. 206 (1888); Oust. t. c. p. 31 (1886); Sharpe, Ibis, 1892, p. 534; Salvad. Mem. R. Accad. Torino, (2) xliv. p. 550 (1894: Warandab); Reichen. Vög. Deutsch-Ost-Afr. p. 96 (1894).

a, *b*. ♂ ♀. Sheik Mahomed, Nov. 1, 1894. Iris dark brown.

According to Heuglin, this large Owl is widely distributed throughout the wooded regions of North-eastern Africa. It is pretty common on the Abyssinian coast-lands, in Takah, on the White and Blue Niles, and ascends high up the Abyssinian mountains. It is not common in Shoa, according to Dr. Ragazzi, but was met with in Turquel by Mr. Jackson, and is recorded by Dr. Reichenow from Tabora, Tanga, the Sigi River, and the southern shores of the Victoria Nyanza.

137. CARINE SPILOGASTRA.

Athene spilogaster, Heugl. Orn. N.O.-Afr. i. p. 119, tab. iv. (1869).

Carine spilogastra, Sharpe, Cat. B. Brit. Mus. ii. p. 138 (1875); Salvad. Mem. R. Accad. Torino, (2) xliv. p. 551 (Durei Katabel ed Habir).

Carine glaux (nec Savign.), Shelley, Ibis, 1885, p. 391.

a, *b*. ♂ ♀ ad. Ahdeh, July 14, 1894.

This species was discovered by Heuglin in the Abyssinian coast-land, between Umkulu and Harkiko, in July. Though Dr. Smith's specimens are rather darker than the figure given by Heuglin, and the rufous streaks on the underparts are broader, I believe that they really belong to Heuglin's species. This is the opinion of Count Salvadori; and I have re-examined Mr. Lort Phillips's specimen, which Capt. Shelley referred to *Carine glaux*, and it is undoubtedly *C. spilogastra*, as suspected by the Count.

138. GLAUCIDIUM PERLATUM.

Noctua perlata (V.); Heugl. t. c. p. 120 (1869).

Glaucidium perlatum, Sharpe, Cat. B. Brit. Mus. ii. p. 209 (1875); Salvad. Ann. Mus. Genov. (2) i. p. 77 (1884); Reichen. Vög. Deutsch-Ost-Afr. p. 97 (1894).

a. ♀ ad. Darro Mountains, Nov. 20, 1894. Iris light yellow; bill greenish yellow.

According to Heuglin this Pigmy Owlet is resident in Abyssinia, Senar, Kordofan, and the White Nile district, its northern limit being the district of the Beni-Amer and Bogos-land. It is found usually singly in the wooded regions, up to 8000 feet. Antinori procured a specimen at Ambo-Karra in Shoa in July, and it is apparently widely distributed in East Africa, as Dr. Reichenow records it from the Pangani and Ronga rivers, Aruscha, Parè, Nguruman, Taiveta, Ugogo, and Mpwapwa.

Order ACCIPITRES.

Fam. FALCONIDÆ.

139. POLYBOROIDES TYPICUS.

Polyboroides radiatus, Heugl. Orn. N.O.-Afr. i. p. 76 (1869).

Polyboroides typicus, Sharpe, Cat. B. Brit. Mus. i. p. 48 (1875);

Salvad. Ann. Mus. Genov. (2) i. p. 75 (1884), vi. p. 204 (1888); Reichen. Vög. Deutsch-Ost-Afr. p. 85 (1894).

a. ♀ ad. Sheik Mahomed, Oct. 28, 1894. Iris dark brown; face cream-colour mottled with orange; base of bill white; legs pale yellow.

Heuglin found the present species resident in Shoa, Fazogl, Senár, Kordofan, and in the country of the White Nile and its tributaries. It is everywhere rare, and was only observed singly, in June on the Blue Nile, in September and October in Kordofan and on the Lower White Nile, in May in the Dinka and Djur countries in the Gazelle River district. Brehm met with it in August and September on the Blue Nile; Rüppell obtained an example in Shoa, and specimens were also procured there both by Antinori and Ragazzi. Mr. Jackson does not appear to have met with the species on any of his journeys, but I have seen a very black immature specimen obtained by Mr. Scott Elliot on Ruwenzori. According to Dr. Reichenow, it has been found on Kilimanjaro, and in Usaramo and Walla, and at Kakoma.

140. CIRCUS MACRURUS.

Circus swainsoni, Heugl. Orn. N.O.-Afr. i. p. 105 (1869); Salvad. Ann. Mus. Genov. (2) i. p. 76 (1884), vi. p. 225 (1888).

Circus macrurus, Sharpe, Cat. B. Brit. Mus. i. p. 67 (1874); id. Ibis, 1892, p. 535; Reichen. Vög. Deutsch-Ost-Afr. p. 86 (1894).

a. Juv. Sheik Mahomed, Nov. 5, 1894. Iris dark brown; feet and base of bill yellow; cere grey.

b. ♀ ad. Budda, Nov. 11, 1894. Iris yellowish brown; feet light yellow; base of bill yellow.

Common in spring and autumn, according to Heuglin, in Senar, Abyssinia, and Kordofan. Antinori met with the species at Daimbi in Shoa in November and December, and Dr. Ragazzi at Dembi in February. Mr. Jackson procured specimens in Turquel in January, and at Machako's in March; and Dr. Reichenow records the species from Igonda.

141. ASTUR SPHENURUS.

Nisus badius (nec Gm.), Heugl. Orn. N.O.-Afr. i. p. 70 (1869).

Astur sphenurus (Rüpp.), Sharpe, Cat. B. Brit. Mus. i. p. 113 (1874).

Scelospizias sphenurus, Salvad. Ann. Mus. Genov. (2) i. p. 72 (1884).

a. ♂ ad. Ehrer River, Aug. 18, 1894. Iris red; cere, feet, and eyelids bright yellow.

This species is recorded from the Dahlak Islands by Rüppell, and by Hemprich and Ehrenberg from Arabia. Heuglin collected it on the coast-land of Abyssinia, in Bogos-land, on the Mareb and near Adowa in Tigrié, in the "Quola" of Western Abyssinia, on the Blue Nile near Senar and Khartoum, and along the whole of the White Nile and Gazelle River, westwards to Kosanga in Equatorial

Africa. It was noticed by Antinori at Daimbi in Shoa in January, but not by Dr. Ragazzi. In the Turquel country Mr. Jackson obtained the Southern race, *Astur polyzonoides*, which is also the form prevalent in East Africa (*cf.* Reichen. t. c. p. 88).

142. MELIERAX POLIOPTERUS.

Melierax poliopterus, Cab.; Sharpe, Cat. B. Brit. Mus. i. p. 88; Salvad. Mem. R. Accad. Torino, (2) xliv. p. 550 (1894); Reichen. Vög. Deutsch-Ost-Afr. p. 86 (1894).

Melierax polyzonus (nec Rüpp.), Oust. Bibl. École Hautes Études, xxxi. art. no. 10, p. 2.

a. ♂ ad. Doda, Nov. 21, 1894.

b, *c*. Ad. Doda, Nov. 22, 1894. Iris brown; base of bill deep yellow; legs salmon-colour.

This species is not known from Shoa, nor has Mr. Jackson met with it in the interior of East Africa, but Dr. Reichenow records it from Speke Gulf and Irangi.

143. MELIERAX GABAR.

Nisus gabar, Heugl. Orn. N.O.-Afr. i. p. 73 (1869).

Melierax gabar (Daud.); Sharpe, Cat. B. Brit. Mus. i. p. 89 (1874); Shelley, Ibis, 1885, p. 391; Sharpe, Ibis, 1892, p. 535; Reichen. Vög. Deutsch-Ost-Afr. p. 87 (1894).

Micronisus gabar, Salvad. Ann. Mus. Genov. (2) i. p. 72 (1884), vi. p. 203 (1888).

a. ♀ juv. Berbera, July 4, 1894.

b. ♂ ad. Boholgarshan, July 15, 1894. Iris reddish brown.

Heuglin states that the "Gabar" is the commonest Hawk in the cultivated lands and on the islands of the Nile in Nubia and Senar; also on the coast of Abyssinia, on the Mareb, in Takah and Kordofan, but is rare on the Upper White Nile. It was not seen in wooded country or on the Abyssinian highlands. His most northern point for the species was between Wadi-Halfa and Dir; but according to Schlegel the species has been obtained near Suez. Antinori procured specimens at Daimbi in Shoa in November, and Dr. Ragazzi met with it in the same country in March, June, and August. Mr. Jackson obtained it at Machako's in March and April, and Dr. Reichenow records it from Useguha and Ukamba.

144. MELIERAX NIGER.

Nisus niger, Heugl. Orn. N.O.-Afr. i. p. 74 (1869).

Melierax niger, Sharpe, Cat. B. Brit. Mus. i. p. 91 (1874); id. Ibis, 1892, p. 535; Reichen. Vög. Deutsch-Ost-Afr. p. 87 (1894).

Micronisus niger, Salvad. Ann. Mus. Genov. (2) i. p. 73 (1884).

a. ♀ ad. Boholgarshan, July 15, 1894. Iris orange.

Heuglin says that this species is often found in localities where *M. gabar* does not occur, as in Bogos-land, high Central Abyssinia, and on the Upper White Nile, but it was not noticed by him in

Dongola, where *M. gabar* is the commonest bird of prey. The northern range of *M. niger* is the Bajuda Steppes; it is resident in Bogos-land and Abyssinia, but was most plentiful in the "Quola" of West Abyssinia, especially in the provinces of Sarago and Qalabat. Antinori met with it at Daimbi in Shoa in May, Mr. Jackson at Turquel in January, and Dr. Reichenow records it from Ukamba.

145. BUTEO AUGUR.

Buteo augur, Heugl. Orn. N.O.-Afr. i. p. 92 (1869); Sharpe, Cat. B. i. p. 175; Shelley, Ibis, 1885, p. 391 (30 miles from Berbera); Sharpe, Ibis, 1892, p. 536; Reichen. Vög. Deutsch-Ost-Afr. p. 93 (1894).

Pterolestes augur, Salvad. Ann. Mus. Genov. (2) i. p. 51 (1884), vi. p. 196 (1888).

a. ♀ ad. Sheik Mahomed, Nov. 5, 1894. Iris golden brown; base of bill and corners of mouth dark greenish yellow; legs light dull yellow.

b. ♀ ad. Budda, Nov. 11, 1894. Iris rich brown; legs and base of bill yellow.

Heuglin says that the Augur Buzzard was found by him from the Taranta Pass, Mensa, and the Tsad-Amba southwards through the whole of Tigrié and Amhara; it is likewise common in Galla-land, very rare on the Blue Nile, in Fazogl and East Senar. On the Tana it was not observed. It is resident, and breeds between 5,000 and 12,000 feet. A very large series of specimens was obtained in Shoa by the Italian naturalists, in nearly every month of the year; Mr. Jackson met with the species in Masai-land in August, in February in Ukambani, and again in the same month on Mount Elgon. Dr. Reichenow records it in East Africa, from Igónda, Ussukúma, Karagwe, and Kagehi.

146. AQUILA RAPAX.

Aquila rapax (Temm.); Heugl. t. c. p. 45 (1869); Sharpe, Cat. B. i. p. 242 (1874); id. Ibis, 1892, p. 537; Reichen. Vög. Deutsch-Ost-Afr. p. 92 (1894).

Aquila albicans, Salvad. Ann. Mus. Genov. (2) i. p. 38 (1884), vi. p. 195 (1888).

a. Ad. Sheik Mahomed, Nov. 1, 1894. Iris golden brown; base of bill, upper and under mandible yellow; cere yellowish; feet light yellow.

b. ♀ ad. Darro Mountains, Nov. 20, 1894. Iris rich brown, mottled whitish; base of bill, corners of mouth, and feet yellow.

According to Heuglin, the Tawny Eagle is spread over the greater part of N.E. Africa. In Egypt and Northern Nubia it is rare and only found in winter. It is common in Southern and Eastern Senar, in Takah, Bogos-land, and throughout the whole of Abyssinia, up to 12,000 feet elevation, as well as on the hot

Samhar coast, as, for instance, in the valleys of Ailat and Azuz. The light form of this Eagle, known as *A. albicans*, was obtained in Shoa by Antinori, who collected many specimens. Mr. Jackson has found the species in Turquel, and Dr. Reichenow records it from Aruscha.

147. HELOTARSUS ECAUDATUS.

Helotarsus ecaudatus (Daud.); Heugl. Orn. N.O.-Afr. i. p. 80 (1869); Salvad. Ann. Mus. Genov. (2) i. p. 46 (1884); Reichen. Vög. Deutsch-Ost-Afr. p. 91 (1894).

a. ♂ ad. Sheik Husein, Sept. 25. Irides rich brown; sides of face and eyebrows orange, with small vermilion blotches; bill bright yellow-ochre at the base, shading abruptly into black towards the apex; feet yellow, varying irregularly from straw- to pale salmon-colour.

Heuglin says that he found the Bateleur Eagle from the Bajuda desert and Takah southwards throughout the whole of Abyssinia, on the Danakil and Somali coasts, in Senar, Kordofan, and the district of the Blue Nile; also on the White Nile and Gazelle River. Antinori records it from the country of the Eisa and Adal Somalis, as well as from Shoa and the Gala country. Mr. Jackson has not yet obtained it, but Dr. Reichenow notes it from Ugalla, Masailand, Wembere, Ussegúha, Kagehi, and the Simiu River.

148. EUTOLMAËTUS SPILOGASTER.

Spizaëtus spilogaster, Du Bus; Heugl. Orn. N.O.-Afr. i. p. 57 (1869).

Nisaëtus spilogaster, Sharpe, Cat. B. Brit. Mus, i. p. 252 (1874); Salvad. Ann. Mus. Genov. (2) i. p. 44 (1884).

a. ♂ ad. Nov. 22, 1894. Bill light grey; feet greenish yellow; iris yellow-ochre.

A male bird in fine adult plumage.

Heuglin says that this species was observed by him in North-eastern Africa in the months of April, May, September, and November, but not during the true winter season. He states that it was nowhere common, but he observed it on the upper Mareb near Gundet, in Hamedo in the province of Tigrié, on the western slope of the Abyssinian highlands near Wohni, and in Qalabat, in East Senar near Doka, and finally on the Blue Nile northwestwards to the neighbourhood of Khartoum. It is not rare at Denz in Shoa, according to Antinori, bnt it has not yet been recorded from East Africa.

149. HALIAËTUS VOCIFER.

Haliaëtus vocifer (Daud.); Heugl. t. c. p. 53 (1869); Sharpe, t. c. p. 310 (1874); Oust. Bibl. École Hautes Études, xxxi. art. 10, p. 1 (1886); Salvad. Ann. Mus. Genov. (2) i. p. 45 (1884), vi. p. 196 (1888); Sharpe, Ibis, 1892, p. 538; Reichen. Vög. Deutsch-Ost-Afr. p. 90 (1894).

a. Ad. Jan. 13, 1895. Iris brown; cere light yellow; bill grey; feet dirty white.

Heuglin found this fine Sea-Eagle in the Upper Nile districts. From Southern Nubia it is seen along the White and Blue Niles, on the Atbara and on Lake Tana. Antinori procured it on Lake Cialalakà, and says that it is not rare along the Duleccia River. Mr. Jackson found it plentiful in Turquel, and Dr. Reichenow says that it is distributed all over East Africa.

150. MILVUS ÆGYPTIUS.

Milvus forskali, Strickl.; Heugl. t. c. p. 98 (1869).

Milvus ægyptius (Gm.); Sharpe, t. c. p. 320 (1874); Oust. t. c. p. 2 (1886); Salvad. Ann. Mus. Genov. (2) i. p. 58 (1884), vi. p. 196 (1888); Reichen. Vög. Deutsch-Ost-Afr. p. 89 (1894).

a. ♂ ad. Furza, Sept. 12, 1894. Iris dark brown; bill, cere, and legs lemon-yellow.

b. ♂ ad. Sheik Husein, Sept. 26, 1894. Iris rich brown; whole of bill dull pale yellow; legs and corners of mouth bright yellow.

c. ♂ imm. Sheik Husein, Sept. 26, 1894. Iris rich brown; bill dark horn-colour, base dull yellow; corners of mouth and legs bright yellow.

The Egyptian Kite is, according to Dr. Heuglin, distributed over the whole of North-eastern Africa, and was found by him on the Arabian coast of the Red Sea, on the Dahlak Islands, in Adel-land and the Somali country, and in Abyssinia up to 12,000 feet. It is resident in Egypt, Nubia, and Abyssinia, but scarcer on the Upper Nile. It is very common in Shoa, according to Dr. Ragazzi, and is said by Dr. Reichenow to be universal throughout Eastern Africa.

151. ELANUS CÆRULEUS.

Elanus melanopterus (Daud.); Heugl. Orn. N.O.-Afr. i. p. 100 (1869).

Elanus cæruleus (Desf.); Sharpe, t. c. p. 336 (1874); Salvad. Ann. Mus. Genov. (2) i. p. 60 (1884), vi. p. 191 (1888); Sharpe, Ibis, 1892, p. 539; Reichen. Vög. Deutsch-Ost-Afr. p. 89 (1894).

a. ♀ imm. Budda, Nov. 11, 1894. Base of bill, corners of mouth, and feet yellow; iris red.

According to Heuglin, this Black-winged Kite is one of the commonest birds of prey in Central and Lower Egypt, rarer at Assouan and in Northern Nubia. In autumn and winter it appears, apparently singly, in the southern portions of Nubia, near Khartoum, in Abyssinia and Takah, Bogos-land, in Kordofan, and on the Blue and White Niles. Heuglin considers it to be less plentiful in Egypt during the winter. Antinori met with it at Daimbi in Shoa in May and November, and Dr. Ragazzi at Soddé in June. In January Mr. Jackson procured a specimen in Turquel; and Dr. Reichenow states that it has been found in German East Africa at Tanga, Karema, and Kagehi.

152. POLIOHIERAX SEMITORQUATUS.

Falco semitorquatus, Smith; Heugl. t. c. p. 38 (1869); Reichen. Vög. Deutsch-Ost-Afr. p. 95 (1894).

Poliohierax semitorquatus, Sharpe, Cat. B. Brit. Mus. i. p. 370 (1874); Salvad. Ann. Mus. Genov. (2) i. p. 64 (1884), vi. p. 199 (1888); Shelley, Ibis, 1885, p. 391 (Somali plateau); Sharpe, Ibis, 1894, p. 539; Salvad. Mem. R. Accad. Torino, (2) xliv. p. 550 (1894: Warandab).

a. ♂ ♀ ad. Moodenner, Nov. 26, 1894. Eyelids, cere, base of bill, and corner of mouth vermilion; feet light red.
b. ♂ ad. Goulf, Nov. 29, 1894. Bill grey; iris brown.
c. ♂ ad. Dunarn, Jan. 4, 1895. Iris brown; feet vermilion.

Heuglin met with this species in the neighbourhood of Gondokoro, and Knoblecher collected it in the Bari-Negro country. A specimen from Shoa is in the British Museum, obtained by Sir W. C. Harris. In the latter country it was met with it at Ambo-Karra in July and August, and Mr. Jackson procured it in Turquel in January. Dr. Reichenow records it from Uniamwési.

153. CERCHNEIS TINNUNCULUS.

Cerchneis tinnunculus (L.); Sharpe, Cat. B. Brit. Mus. i. p. 425 (1894); id. Ibis, 1892, p. 540.

Tinnunculus tinnunculus (L.); Shelley, Ibis, 1885, p. 392.

Tinnunculus neglectus, Salvad. Ann. Mus. Genov. (2) i. p. 65 (1884), vi. p. 200 (1888).

Falco tinnunculus, Reichen. Vög. Deutsch-Ost-Afr. p. 93 (1894).

a. ♂ ad. Darro Mountains, Aug. 18, 1894.
b. ♀ ad. Sheik Mahomed, Nov. 1, 1894.

These specimens belong to the small dark resident race of Kestrel found in North-east Africa, and not to the ordinary migratory form of Europe. Count Salvadori considers the Kestrel of Shoa to be distinct and calls it *T. neglectus* of Schlegel, but I think it is impossible to separate these dark forms of resident mountain Kestrels specifically. Dr. Reichenow records the Kestrel from the Pangani River, Igonda, and Kakoma.

Order ANSERIFORMES.

154. CHENALOPEX ÆGYPTIACA.

Chenalopex ægyptiacus (L.); Heugl. Orn. N.O.-Afr. ii. p. 1285 (1873); Salvad. Ann. Mus. Genov. (2) i. p. 241 (1884), vi. p. 319 (1888); Sharpe, Ibis, 1892, p. 541; Salvad. Mem. R. Accad. Torino, (2) xliv. p. 564 (1894: Gurat); Reichen. Vög. Deutsch-Ost-Afr. p. 28 (1894).

Anser (*Chenalopex*) *ægyptiacus*, Oust. Bibl. École Hautes Études, xxxi. art. 10, p. 12 (1886).

a. ♀ ad. Sheik Husein, Sept. 20, 1894. Iris orange; bill dull crimson, black at and round the edge; legs fleshy pink.

This species appears to be universally spread over East Africa.

155. ANAS UNDATA.

Anas xanthorhyncha, Forst.; Heugl. Orn. N.O.-Afr. ii. p. 1316 (1873); Salvad. Ann. Mus. Genov. (2) i. p. 243 (1884), vi. p. 320 (1888); Reichen. Vög. Deutsch-Ost-Afr. p. 26 (1894).

Pœcilonetta erythrorhyncha (Gm.); Shelley, Ibis, 1885, p. 415; Salvad. t. c. p. 564 (1894: Gurat).

Querquedula erythrorhyncha, Oust. t. c. p. 12 (1886); Sharpe, Ibis, 1892, p. 541.

a, b. ♂ ♀ ad. Sheik Mahomed, Nov. 3, 1894. Iris light brown; bill bright yellow-ochre and black; legs brown.

Antinori states that this Duck was frequent on the waters of the Woddeccia in Shoa in May, and in the marshes of the higher plateaux, but was not seen low down in the "Kolla." Dr. Ragazzi met with it on Lake Addo in February and June, and in the latter month on Lake Cialalakà. Mr. Jackson procured it at Machako's in February, and Dr. Reichenow records it from the Victoria Nyanza.

Order PELARGIFORMES.

Fam. ARDEIDÆ.

156. BUBULCUS IBIS.

Ardea ibis (L.); Heugl. Orn. N.O.-Afr. ii. p. 1069 (1873).

Bubulcus bubulcus, Salvad. Ann. Mus. Genov. (2) i. p. 228 (1884).

Bubulcus lucidus, Salvad. Ann. Mus. Genov. (2) vi. p. 314 (1888).

Bubulcus ibis, Reichen. Vög. Deutsch-Ost-Afr. p. 64 (1894).

a. ♂ ad. Shebeli, Aug. 27, 1894. Iris white round the pupil, merging into red; bill yellow-ochre at tip, merging into red; cere round the eye grey, red at base of bill; legs yellow-ochre, feet darker.

b. ♀ ad. Merconfu, Jan. 11, 1895. Bill and legs yellow-ochre; iris straw-yellow.

c, d. ♂ ♀ ad. Merconfu, Jan. 11, 1895. Iris straw-yellow; bill yellow-ochre; legs black.

Heuglin says that this Egret is resident in Egypt, and also southwards in North-eastern Africa between 18° and 14° N. lat., breeding, but disappearing during the dry and hot season (January to May). In the swamps of the Western Nile region it is also met with, and is not rare on the Abyssinian lowlands to the Dembea plains. He also saw it once in Arabia Petræa. In Shoa it occurs everywhere in large flocks, according to Antinori; and Dr. Reichenow records the species from a number of places between Bagamoyo and the Victoria Nyanza.

Fam. SCOPIDÆ.

157. SCOPUS UMBRETTA.

Scopus umbretta (Gm.); Heugl. Orn. N.O.-Afr. ii. p. 1091

(1873); Salvad. Ann. Mus. Genov. (2) i. p. 229 (1884), vi. p. 315 (1888); Sharpe, Ibis, 1892, p. 542; Reichen. Vög. Deutsch-Ost-Afr. p. 61, fig. 32 (1894).

a. ♀ ad. Sheik Husein, Sept. 25, 1894. Iris dark brown; eyelids, bill, and feet black.

Heuglin records this species as occurring along the coast of the Red Sea up to 18° N. lat., throughout the whole of Abyssinia south from the Adel Mountains to Shoa. In the interior of Abyssinia it reaches an elevation of 10,000 feet, and is even more plentiful on the western slope of the Ethiopian highlands, towards Barka, on the Setit and the other tributaries of the Atbara, near Qalabat, the sources of the Dender and Rahad in Fazogl, Southern Kordofan, and on the torrents which flow into the Sobat, Kir, Gazelle, Djur, and Kosanga rivers. In September Antinori procured a specimen in Shoa, and Dr. Ragazzi did the same in October and February. Mr. Jackson met with the species at Machako's in March; and Dr. Reichenow gives the following localities in German East Africa:—Pangani River, Usambara, Bagamoyo, Ugálla, on the Victoria Nyanza (breeding in December), Tabóra, Aruscha, Ukamba, Mgéra, Ugogo.

Suborder PLATALEÆ.

158. IBIS ÆTHIOPICA.

Ibis æthiopica (Lath.); Heugl. Orn. N.O.-Afr. ii. pt. 1, p. 1135 (1873: C. & S. Nubia; Taka); Oust. t. c. p. 11 (1886); Salvad. Ann. Mus. Genov. (2) i. p. 230 (1884), vi. p. 316 (1888); Reichen. Vög. Deutsch-Ost-Afr. p. 56, fig. 27 (1894); Sharpe, Cat. B Brit. Mus. xxvi. p. 4.

a, b. ♂ ♀ ad. Bainhou, Jan. 10, 1894. Iris brown.

Heuglin states that the Sacred Ibis is a migrant in Central and Southern Nubia, Takah, Senar, and Kordofan, returning during the summer rainy season. He noticed it in Southern Senar in May, near Khartoum at the beginning of July, near Berber, and in Dongola a little later. In January and February he found large flocks on the Tana Lake and near the mouth of the Sobat. In August and September it was in pairs in the Dahlak Archipelego. The Italian traveller Antinori met with the species in Shoa at Lake Cialalakà in April, and Dr. Ragazzi in the same place in February, as well as at Antoto in December. Mr. Jackson does not seem to have come across the species, but, according to Dr. Reichenow, it has been found at the following places in German East Africa:—Bagamoyo, Wualaba, Ussambara, on the Méru Mountains, at Sigirari, and on the Victoria Nyanza.

159. HAGEDASHIA HAGEDASH.

Ibis hagedash (Lath.); Heugl. Orn. N.O.-Afr. ii. p. 1141 (1873); Shelley, Ibis, 1885, p. 415; Oust. t. c. p. 11 (1886); Sharpe, Ibis, 1892, p. 542.

Theristicus leucocephalus, Reichen. Vög. Deutsch-Ost-Afr. p. 55 (1894).

a. ♂ ad. Bainhou, Jan. 10, 1894. Iris white; ridge at base of upper mandible crimson; cere black.

Heuglin considers this species to be a resident in the southern portions of North-eastern Africa. It was tolerably common on the White and Blue Niles, as well as on the Sobat, and according to Rüppell it is found on Lake Tana in Abyssinia. It does not apparently reach to Khartoum, but Heuglin once saw the species near Abu Haraz and on the Schiluk Islands.

The species was not met with in Shoa by the Italian travellers, but Mr. Jackson has obtained it on the Victoria Nyanza, and Dr. Reichenow further records it from Ussambara, Ugalla, Aruscha, and Teita.

Order CHARADRIIFORMES.

160. Œdicnemus affinis.

Œdicnemus affinis, Heugl. Orn. N.O.-Afr. ii. p. 990 (1873); Sharpe, Cat. B. Brit. Mus. xxiv. p. 17 (1895).

a, b. ♀ ad. Sibbe, Aug. 3, 1894. Base of bill and feet yellow; tarsi and toes mottled with brown down the front.

A resident species, according to Heuglin, from the Samhar coast to the Somali country. In September and October he met with it in Eastern Kordofan, at the foot of the Arashkol Mountains, and between the months of November and January in the country of the Upper Kir and Gazelle Rivers. Mr. Blanford procured the species in the Anseba Valley in Bogos-land.

161. Rhinoptilus hartingi.

Rhinoptilus gracilis (nec Cab.); Shelley, Ibis, 1885, p. 416.

Rhinoptilus hartingi, Sharpe, Cat. B. Brit. Mus. xxiv. p. 46 (1895).

a. ♀ ad. Ahdeh, July 14, 1894.

b. ♂ juv. Sibbe, Sept. 3, 1894. Legs greyish white, overlapped edge of each scale grey, merging into a bright white on the overlapping edge.

This is the Somali-land form of *R. bisignatus.*

162. Rhinoptilus cinctus.

Cursorius cinctus, Heugl. Orn. N.O.-Afr. ii. p. 972 (1873); Reichen. Vög. Deutsch-Ost-Afr. p. 32 (1894).

Rhinoptilus cinctus, Shelley, Ibis, 1885, p. 416; Sharpe, Cat. B. Brit. Mus. xxiv. p. 46, pl. iii. fig. 2 (1895).

a. ♀ ad. Selon, Aug. 8, 1894. Iris black; legs dirty white.

b. ♂ ad. Lammo, Aug. 12, 1894. Iris brown; base of bill yellow.

This species was discovered by Heuglin in the country of the

Bari Negroes on the Upper Kir River in 5° N. lat. Dr. Reichenow records it from the Victoria Nyanza, Mkaramo, and Masai-land. It has also been obtained by Mr. Hunter near the Useri River.

163. HOPLOPTERUS SPINOSUS.

Hoplopterus spinosus (Linn.); Heugl. Orn. N.O.-Afr. ii. p. 1004 (1873); Oust. t. c. p. 12 (1886); Salvad. Ann. Mus. Genov. (2) i. p. 219 (1884), vi. p. 300 (1888); id. Mem. R. Accad. Torino, (2) xliv. p. 563 (1894: Gurat); Sharpe, Cat. B. Brit. Mus. xxiv. p. 157 (1895).

Vanellus spinosus, Reichen. Vög. Deutsch-Ost-Afr. p. 36 (1894).

a. ♂ ad. Lubba-gait, Jan. 8, 1895. Iris red.

The Spur-winged Plover occurs throughout North-eastern Africa from Egypt to Nubia, and, according to Heuglin, on the Atbara, the Lower White and Blue Niles, and in the swamps of Eastern Kordofan. In Abyssinia and along the coast of the Red Sea it is only met with on the streams of the hot valleys. He also saw a pair of this Plover on the Djur River. Antinori procured several specimens at Lake Cialalakà in Shoa in April and May, and Dr. Ragazzi in the same locality in February and June. Dr. Reichenow records it from Masai-land and the Victoria Nyanza.

164. STEPHANIBYX CORONATA.

Stephanibyx coronatus (Bodd.), Salvad. Ann. Mus. Genov. (2) i. p. 220 (1884); id. Mem. R. Accad. Torino, (2) xliv. p. 564 (1894: Plains of the Warandab); Sharpe, Cat. B. Brit. Mus. xxiv. p. 178 (1895).

Chettusia coronata, Oust. t. c. p. 12 (1886).

Vanellus coronatus, Reichen. Vög. Deutsch-Ost-Afr. p. 35 (1894).

a. ♀ ad. Bordwain, Jan. 1, 1895. Irides golden yellow; base of bill vermilion; feet vermilion.

Though not mentioned by Heuglin in his great work, the species was once obtained in Shoa by Antinori, at Daimbi in May. In the Steppe-land of East Africa Dr. Reichenow says it is not rare, and he records it from numerous localities from Masai-land to Bukóme.

165. OXYECHUS TRICOLLARIS.

Charadrius tricollaris, Vieill.; Heugl. Orn. N.O.-Afr. ii. p. 1027 (1873); Reichen. Vög. Deutsch-Ost-Afr. p. 34 (1894).

Ægialitis tricollaris, Salvad. Ann. Mus. Genov. (2) i. p. 218 (1884), vi. p. 309 (1888); Shelley, Ibis, 1885, p. 417; Sharpe, Ibis, 1892, p. 544.

Oxyechus tricollaris, Sharpe, Cat. B. Brit. Mus. xxiv. p. 247 (1895).

a. ♂ ad. Lafarok, July 12, 1894.

Heuglin states that this little Plover is not rare along the brooks which discharge themselves along the coast of Samhar, in Tigrié and Amhara westwards to Qalabat; it is found between 1000 and 8000 feet, occurring on Lake Tana. It does not seem to be very plentiful in Shoa, but was obtained there by the Italian naturalists. Mr. Jackson met with it in Ukambani; and Dr. Reichenow records it from Ussagara, the Ugalla River, Lake Tanganyika, and Irangi, in German East Africa.

166. TRINGOIDES HYPOLEUCUS.

Tringoides hypoleucus (L.); Heugl. Orn. N.O.-Afr. ii. p. 1172 (1873); Salvad. Ann. Mus. Genov. (2) i. p. 222 (1884).

Totanus hypoleucus, Reichen. Vög. Deutsch-Ost-Afr. p. 42 (1894).

a. ♂ ad. Dullaat, July 13, 1894.

Found throughout North-eastern Africa, according to Heuglin, both on the sea-coast and on the inland waters, and receiving accessions of numbers in spring, autumn, and winter. It goes south to East Kordofan, to the White and Blue Niles, to Abyssinia and the Gulf of Aden. Antinori procured several specimens at Lake Cialalakà in Shoa in November, and Dr. Reichenow records it from the Pangani and Ugalla rivers and Lake Tanganyika.

Order PODICIPEDIDIFORMES.

167. TACHYBAPTES CAPENSIS.

Podiceps minor, L.; Heugl. Orn. N.O.-Afr. ii. p. 1363 (1873).

Podiceps fluviatilis capensis, Shelley, Ibis, 1885, p. 415.

Podiceps capensis, Licht.; Salvad. Ann. Mus. Genov. (2) i. p. 253 (1884); id. Mem. R. Accad. Torino, (2) xliv. p. 564 (1894).

Tachybaptes capensis, Salvad. Ann. Mus. Genov. (2) vi. p. 326 (1888).

Colymbus fluviatilis (nec Tunst.), Reichen. Vög. Deutsch-Ost-Afr. p. 17 (1894).

a. Ad. Sheik Mahomed, Nov. 3, 1894. Iris brown; legs grey, mottled lighter; corners of mouth and base of under mandible greenish white.

I described the African bird last year, under the impression that the name *P. capensis* was a *nomen nudum*. I find, however, that Count Salvadori had given a diagnosis of the species in 1884, and it stands, therefore, as *Tachybaptes capensis* (Salvad.).

Heuglin does not distinguish between the African and European Little Grebes. He procured the species once in the Abyssinian highlands in summer plumage, and this was doubtless *T. capensis*. The bird which he speaks of as occurring in Egypt in winter is *T. minor*, and this may be the species of Kordofan and the Blue Nile.

Antinori met with the Little Grebe in Shoa in March and April. Dr. Reichenow notices it from Igonda, the Pangani River, Lake Jipi, where it breeds, as well as in Masai-land.

Order RALLIFORMES.

168. Fulica cristata.

Fulica cristata, Gm.; Heugl. Orn. N.O.-Afr. ii. p. 1222 (1873); Salvad. Ann. Mus. Genov. (2) i. p. 225 (1884), vi. p. 313 (1888); id. Mem. R. Accad. Torino, (2) xliv. p. 564 (1894: Gurat); Sharpe, Cat. B. Brit. Mus. xxiii. p. 215 (1894); Reichen. Vög. Deutsch-Ost-Afr. p. 50 (1894).

a. ♀ ad. Sheik Mahomed, Nov. 3, 1894. Legs and bill grey; shield greyish white, with two chocolate-coloured bulbs at the posterior end; iris red.

Found by Heuglin in large flocks on Lake Tana at the end of April and the beginning of May, by Lefebvre in Enderta in May, and by Mr. Blanford also common on Lake Ashangi. It appears to be migratory, as Heuglin states that he never saw any on Lake Tana in the winter months (February and March). Antinori procured several specimens on Lake Cialalakà in Shoa, in April and May, and Dr. Ragazzi also met with the species there in February; Dr. Reichenow records it from the Masai Steppes and Victoria Nyanza.

Order COLUMBIFORMES.

169. Vinago waalia.

Treron waalia, Gm.; Heugl. Orn. N.O.-Afr. i. p. 817 (1871); Shelley, Ibis, 1885, p. 414; Salvad. Ann. Mus. Genov. (2) i. p. 205 (1884), vi. p. 302 (1888).

Vinago waalia, Salvad. Cat. B. Brit. Mus. xxi. p. 15 (1893); id. Mem. R. Accad. Torino, (2) xliv. p. 561 (1894: Mandera and Goolis Mts.).

a. ♂ ad. Near Selon, Aug. 9, 1894. Iris vermilion, with a ring of blue; bill grey; nostrils dark red; feet light yellow-ochre.

A resident species in North-eastern Africa, as it was observed by Heuglin in every month except June and July. From the mountains of Abyssinia south-west over the whole country to Fazogl and the district of the White Nile to the Djur and Kosanga rivers. Its northern limit is the Anseba Valley and Ain. The Italian travellers met with it in Shoa in March, April, and May.

170. Columba albitorques.

Columba albitorques, Rüpp.; Heugl. Orn. N.O.-Afr. i. p. 826 (1871); Salvad. Ann. Mus. Genov. (2) i. p. 206 (1884), vi. p. 303 (1888); id. Cat. B. Brit. Mus. xxi. p. 265 (1893).

a. ♂ ad.; *b*, *c*. ♀ ad. Ginnier, Nov. 17, 1894. Iris dark brown; legs crimson.

Found in Eastern and Central Abyssinia, where, says Heuglin, it is a mountain species, occurring between 6000 and 10,000 feet. Rüppell found it breeding on the Taranta Mountains. South of Begemeder and west of the Tana Lake it was not noticed by Heuglin, who states that it is also absent in Bogos-land, but is common in Hamasién, Akulo-Qusai, on the Adoa, and in Wogara and Semién. Antinori found the species breeding at Licce on the high plateaux of Shoa in November, and Ragazzi procured it in December and July.

171. COLUMBA GUINEA.

Columba guineensis, Heugl. Orn. N.O.-Afr. i. p. 822 (1871).

Columba guinea, Salvad. Ann. Mus. Genov. (2) i. p. 206 (1884); id. Cat. B. Brit. Mus. xxi. p. 266 (1893); Reichen. Vög. Deutsch-Ost-Afr. p. 70 (1894).

a. ♂ ad.; *b.* Ad. Milmil, July 30, 1894.

In North-eastern Africa this Pigeon is said by Heuglin to be found in many different localities, both in the plains and in the mountains up to 10,000 feet, and it occurs from Eastern Abyssinia, Bogos-land, and Takah, from 16°–17° N. lat., to the White and Blue Niles and their tributaries. Antinori found it common in Shoa; and Dr. Reichenow gives the names of many localities for it between Ugogo and the Victoria Nyanza.

172. TURTUR SENEGALENSIS.

Turtur senegalensis (L.); Heugl. Orn. N.O.-Afr. i. p. 841 (1871); Salvad. Ann. Mus. Genov. (2) i. p. 208 (1884), vi. p. 304 (1888); Sharpe, Ibis, 1891, p. 547; Salvad. Cat. B. Brit. Mus. xxi. p. 448 (1893); Reichen. Vög. Deutsch-Ost-Afr. p. 68 (1894).

a. ♂ ad. Milmil, July 28, 1894.

Heuglin calls this one of the commonest of the resident birds of North-eastern Africa. In Abyssinia it does not go higher than 7000 or 8000 feet. In the district of the Upper White Nile it is rarer than in Nubia, Egypt, Arabia, and the Abyssinian coast. Antinori procured the species in Shoa at Mahal-Uonz in November, and in the Adda Gala country in May; it was also met with in Shoa by Dr. Ragazzi in June, July, November, and December. Mr. Jackson obtained it in Turquel, and also in the Teita district; and it is recorded by Dr. Reichenow from many localities in East Africa from Ugogo to Kagehi.

173. TURTUR LUGENS.

Turtur lugens (Rüpp.); Heugl. Orn. N.O.-Afr. i. p. 838 (1871); Salvad. Cat. B. Brit. Mus. xxi. p. 408 (1893).

a. ♀ ad. Sheik Husein, Sept. 26, 1894. Iris bright yellow-ochre; cere, eyelids, corners of mouth, and legs dull crimson; bill and nostrils very dark grey.

According to Heuglin, this Turtle Dove is found in the high lands of Abyssinia between 6000 and 10,000 feet, from Hamasién and the Taranta Pass as far as Sémien, Wogara, and Begemeder, but was not observed by him in Gala-land or to the westward of the Tana Lake.

174. TURTUR DAMARENSIS.

Turtur damarensis, F. & H.; Heugl. Orn. N.O.-Afr. i. p. 838 (1871); Salvad. Cat. B. Brit. Mus. xxi. p. 426 (1893); Reichen. Vög. Deutsch-Ost-Afr. p. 69 (1894).

Turtur capicola (nec Sund.), Sharpe, Ibis, 1892, p. 546.

a. ♂ ad. Lafarok, July 12, 1894.

Apparently not found in N.E. Africa, but it extends from Damara-land and the Transvaal throughout the whole of East Africa, and was found by Mr. Jackson in Kitosh. Dr. Reichenow gives a number of places for the species, from the Pangani River to Bussissi in the south of the Victoria Nyanza.

175. ŒNA CAPENSIS.

Œna capensis (L.); Heugl. Orn. N.O.-Afr. i. p. 848 (1871); Salvad. Ann. Mus. Genov. (2) i. p. 209 (1884), vi. p. 305 (1888); Oust. t. c. p. 11 (1886); Salvad. Cat. B. Brit. Mus. xxi. p. 501 (1893); id. Mem. R. Accad. Torino, (2) xliv. p. 561 (1894); Reichen. Vög. Deutsch-Ost-Afr. p. 71 (1894).

a. ♂ juv. Berbera, July 3, 1894.
b. ♂ ad. Sassabané, July 31, 1894.

Occurs in the Nile regions and on the Red Sea coasts, as far as 23° N. lat. South of this it is said by Heuglin to be common in the coast-lands of Abyssinia south to the Gulf of Aden, and in the warmer portions of Abyssinia it ascends to 7000 feet. Near Khartoum he found it breeding. It is common in Shoa, according to Antinori and Ragazzi, and is shown by Dr. Reichenow to be widely distributed in East Africa, from Bagamoyo to Masai-land and the Victoria Nyanza.

176. CHALCOPELIA AFRA.

Chalcopelia afra (L.); Heugl. Orn. N.O.-Afr. i. p. 845 (1871); Salvad. Ann. Mus. Genov. (2) vi. p. 304 (1888); Sharpe, Ibis, 1892, p. 547; Salvad. Cat. B. Brit. Mus. xxi. p. 506 (1893); id. Mem. R. Accad. Torino, (2) xliv. p. 561 (1894); Reichen. Vög. Deutsch-Ost-Afr. p. 71 (1894).

a. ♂ ad. Ehrer, Aug. 18, 1894.
b. ♀ ad. Sheik Husein, Sept. 27, 1894. Iris dark brown; legs dull crimson; cere dark grey.
c. ♀ ad. Mt. Kuldush, Dec. 18, 1894.

Heuglin gives the northern limit of this species in N.E. Africa, as 17° or 18° N. lat. in Berber and Takah. It appears both on the coast-lands and in the mountains of Abyssinia, in the latter up to 8000 feet, also in Senar, Kordofan, and in the country of the White Nile and its tributaries, as well as in Danakil and Somali-land, and is a resident species. Antinori did not meet with this Pigeon in Shoa, but Dr. Ragazzi found it common near the streams of Fallé in March. Mr. Jackson procured a specimen on Mt. Elgon in February, and it is recorded by Dr. Reichenow from a number of localities between Dar-es-Salaam and the Victoria Nyanza.

Order PTEROCLETES.

177. Pterocluru s exustus.

Pterocles exustus, Temm.; Heugl. Orn. N.O.-Afr. ii. p. 855 (1873); Salvad. Ann. Mus. Genov. (2) vi. p. 306 (1888); Reichen. Vög. Deutsch-Ost-Afr. p. 55 (1894).

Pteroclurus exustus, Ogilvie-Grant, Cat. B. Brit. Mus. xxii. p. 12 (1893); Salvad. *t. c.* p. 561 (1894: Hento Valley: Lido Mts.).

a, b. ♂; *c, d.* ♀ ad. Milmil, July 30, 1894.

This Sand-Grouse is common in Egypt, and reaches along the Nile to Northern Nubia. Heuglin met with it in Arabia Petræa and on the Red Sea south to Massowa. Dr. Ragazzi procured it once at Cialalakà in Shoa, in February. Dr. Reichenow states that it has occurred in Aruscha, on the Masai Steppes, and in the Kilima-njaro district.

178. Pterocles decoratus.

Pterocles decoratus, Cab.; Heugl. Orn. N.O.-Afr. ii. p. 870 (1873); Sharpe, Ibis, 1892, p. 549; Ogilvie-Grant, Cat. B. Brit. Mus. xxii. p. 21 (1893); Salvad. t.c. p. 561 (1894: Habir Valley); Reichen. Vög. Deutsch-Ost-Afr. p. 54 (1894).

a. ♂ ad. Okoto, Sept. 8, 1894.

Found, according to Dr. Reichenow, at Mkaramo, the Masai Steppes, the Kilima-njaro district, Lake Jipi, the Ronga River, and the Wambere Steppes. Mr. Jackson procured it on the Tsauro River.

Order GALLIFORMES.

179. Acryllium vulturinum.

Numida vulturina, Hardw.; Shelley, Ibis, 1885, p. 414.

Acryllium vulturinum (Hardw.); Sharpe, Ibis, 1891, p. 554; Ogilvie-Grant, Cat. B. Brit. Mus. xxii. p. 385 (1893); Salvad. Mem. R. Accad. Torino, (2) xliv. p. 562 (1894); Reichen. Vög. Deutsch-Ost-Afr. p. 74, fig. 36 (1894).

a. ♂ ad. Ducheto, Aug. 10, 1894. Iris scarlet; bare head and neck grey; bill grey, lighter at point.
b. ♀ ad. Shebeli, Sept. 8, 1894.

This East-African species is found in the Teita district, on the Pangani, in Uzaramo, Aruscha, the Ronga River, and the Masai Steppes.

180. Francolinus castaneicollis.

Francolinus castaneicollis, Salvad. Ann. Mus. Genov. xxvi. p. 542 (1888); Grant, Cat. B. Brit. Mus. xxii. p. 153 (1893).

a. ♂ ad. Sheik Mahomed, Nov. 2, 1894. Iris dark brown; feet brownish orange; bill vermilion.

b. ♀ ad. Sheik Mahomed, Nov. 8, 1894. Iris brown; feet salmon-colour; bill brown, lower mandible reddish.

Discovered in Shoa at Lake Ciar-Ciar.

181. Francolinus granti.

Francolinus granti, Hartl.; Heugl. Orn. N.O.-Afr. ii. p. 891 (1873); Sharpe, Ibis, 1892, p. 551; Ogilvie-Grant, Cat. B. Brit. Mus. xxii. p. 148 (1893); Salvad. Mem. R. Accad. Torino, (2) xliv. p. 562 (1894: Odeuin Plains); Reichen. Vög. Deutsch-Ost-Afr. p. 78 (1894).

a. ♀ ad. Sassabane, July 31, 1894. Iris brown; feet light red.

Mr. Jackson procured examples of this species at Machako's and again on the Victoria Nyanza. Between the lake and the coast Dr. Reichenow gives many localities where it has occurred.

June 18, 1895.

Sir W. H. Flower, K.C.B., LL.D., F.R.S., President,
in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of May:—

The registered additions to the Society's Menagerie during the month of May were 130 in number. Of these 67 were acquired by presentation, 24 by purchase, 3 by exchange, 15 were born in the Gardens, and 21 were received on deposit. The total number of departures during the same period, by death and removals, was 90.

Among these, special attention may be called to the following:—

1. A Black-billed Sheathbill (*Chionis minor*), captured at sea, in about 52° S., 55° W., and presented by Mr. John Gunn, of the German Barque 'Prof. Koch,' May 1st.

We have now specimens of both species of the Sheathbills (*Chionis alba* and *C. minor*) living in the Society's Gardens.

2. A female Grysbok (*Neotragus melanotis*), presented by J. E. Matcham, Esq., of Port Elizabeth, South Africa, and received May 26.

This is one of the smaller Cape Antelopes rarely seen in captivity; we have received no specimen of it for the last twenty years.

3. A young male Panolia Deer (*Cervus eldi*) from Southern China, presented by Julius Neumann, Esq., C.M.Z.S., and received May 29, 1895.

So far as I know, the only specimen of this beautiful Deer previously received by the Society was the female presented by Mr. A. Grote in 1867, which was figured in the Society's Transactions (vol. vii. pls. xxxvii.–xxxviii.); see also P. Z. S. 1867, p. 821.

I also take this opportunity of mentioning that the animal presented to the Society on the 28th March, 1894, by Mr. A. Murray, and entered as a Kinkajou (as it was called by the donor), appears to be a specimen of the rare American Carnivore *Bassaricyon alleni*, Thomas, P. Z. S. 1880, p. 397, pl. xxxviii., with the apical portion of the tail removed. Mr. Murray informs us that this specimen was captured in the woods at Bastrica on the Essequibo River, British Guiana.

Referring to his note on the occurrence of the Barbary Sheep (*Ovis tragelaphus*) in Egypt, read on January 15th last (see P. Z. S. 1895, p. 85), Mr. Sclater exhibited the head of this sheep, obtained by Captain J. G. Dunning near Wady Halfa, which, at the time of reading his note, Mr. Sclater had spoken of as "not having been received," but which had arrived since.

Mr. Sclater said there could be no doubt as to the specimen in question belonging to the Barbary Sheep, *Ovis tragelaphus*. Captain Dunning, having unfortunately lost his life in Uganda, Mr. Sclater stated that he proposed to deposit the present specimen in the British Museum.

Mr. Sclater exhibited the skin of a Humming-bird (*Anthocephala berlepschi*, Salvin, Ibis, 1894, p. 120), which he had received in a letter addressed to him by Mr. Robert B. White, C.M.Z.S., from Palencia, a department of Cauca, Republic of Colombia, April 15th, 1895. Mr. White observed that this species until recently was supposed to be unknown in Colombia; he had lately found it, but only in one locality, in the extreme south of the Magdalena Valley, where it was by no means easy to obtain it.

Prof. G. B. Howes exhibited the skull of a Rabbit destitute of the second pair of upper incisors, which he owed to the acumen of his Laboratory Attendant, J. E. Redsull.

The animal from which this specimen had been obtained was an old "Hare-coloured" or "Belgian" Rabbit, purchased in the market, and was in no other respect observed to be abnormal. Prof. Howes had met with specimens showing the absence of one of the smaller incisors on the right and on the left side, and one in which the left tooth was wanting, that of the right being greatly hypertrophied, its alveolus being almost as large in area as that of the first incisor[1]. As the skull exhibited was the first, among some thousands which had passed through his hands, in which both the second incisors were wanting, and as von Nathusius, in his lengthy experience of the Leporines, had recorded[1] but two similar cases, the variation would appear to be very exceptional. In the specimen exhibited the single pair of incisors in both upper and lower jaw were longer and more curved than is usual where the smaller upper incisors are present. This was most marked in the lower jaw, the cutting-edges of the incisors, instead of terminating posteriorly on a level with the upper surface of the symphysial end of the mandible, standing 3 millim. above it. In this greater elongation of the incisors the specimen approximated the more closely towards the simplicidentate type.

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[1] Specimens of these were exhibited.

Nathusius had remarked of one of the two examples which fell into his hands that not only were there no traces of the teeth in question, but that there were no indications of their having been developed and subsequently lost. In the specimen which Prof. Howes exhibited the premaxillæ bore a couple of excessively minute perforations, which might possibly be the reduced vestiges of the alveoli of the missing teeth. That of the left side, however, led off into an outwardly directed groove, and from the characters of these passages, in consideration of the recent careful investigation of Aschenbrandt[2], he was disposed to regard them as those of transit of palatal branches of the naso-palatine nerve.

The cheek-teeth of the specimen showed no features that were exceptional.

A letter was read, addressed to the Secretary by Dr. A. A. W. Hubrecht, F.M.Z.S., calling attention to the account of a supposed new Mammal from Sumatra by him, published in the 'Notes from the Leyden Museum' (vol. xiii. p. 241), under the belief that it would turn out to be an unknown species of Edentate, and which he had proposed to call *Trichomanis hoevenii*. Further inquiries and information received from Mr. Pruys Van der Hoeven (after whom the supposed new animal had been named) had convinced Dr. Hubrecht that it was an *Arctonyx* (*A. collaris*), and that no further hopes could be entertained of the existence of an unknown Edentate in the forests of Sumatra.

In reference to his remarks made at the last meeting (see above, p. 400) on the existence of a second Gazelle in Egypt, besides *Gazella dorcas*, Mr. Sclater exhibited the skin and skull of the male Gazelle of this second species which he had seen alive at Cairo. These had been kindly sent to him by Mr. Jennings Bramley. Mr. Sclater had ascertained, by comparison with one of the typical specimens in the British Museum, that they were referable to Mr. Thomas's lately described species *Gazella loderi* (P. Z. S. 1894, p. 470, pl. xxxii.), the extension of which into Egypt was a novel fact of great interest.

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[1] Der zoolog. Garten, Jhg. xx. p. 134.

[2] Verhandl. d. phys.-med. Gesellsch, Würzburg, n.F. Bd. xx. No. 2 (p. 11).

This Gazelle was said to be known to the Arabs of the Libyan or Western Desert of Egypt as the "Ghazal abiad," or White Gazelle; but was certainly not nearly so common as *Gazella dorcas*, which occurred in both the Eastern and Western Deserts.

Mr. W. Saville Kent, F.Z.S., exhibited a coloured sketch of a species of Nudibranchiate Mollusk, which he had met with in Western Australia, remarkable for its large size and colouring, and probably referable to *Doris* or an allied genus.

A communication was read from Messrs. F. E. Beddard, M.A., F.R.S., and A. C. Haddon, M.A., M.R.I.A., containing descriptions of a number of new species of Nudibranchiate Mollusks, examples of which had been collected by the latter author during his recent stay in the neighbourhood of Torres Straits.

This paper will be published entire in the Society's 'Transactions.'

Mr. G. A. Boulenger, F.R.S., gave an account of a large collection of Fishes formed by Dr. C. Ternetz at various localities in Matto Grosso and Paraguay. So few Fishes had been collected in the Paraguay system since the time of Natterer, that it seemed desirable that a full list of all the species represented in the present collection should be given. This was accordingly done, the specimens being referred to 97 species, of which the following were described as new:—

1. PLAGIOSCION TERNETZI, sp. n.

Outer, upper, and inner lower teeth considerably enlarged. Depth of body 3 times in total length, length of head 3 to $3\frac{1}{4}$ times; snout a little longer than diameter of eye, which is 5 to $5\frac{1}{2}$ times in length of head; interorbital width equal to length of snout, 4 times in length of head; maxillary extending to below posterior border of eye; præopercular border rounded, finely denticulated behind, with wide-apart small serræ at the angle and below. 15 gill-rakers on lower part of anterior arch, the longest as long as or a little shorter than longest gill-filaments. Lower pharyngeal teeth villiform. Dorsal X, I 33–35: third and fourth or fourth and fifth spines longest, $\frac{1}{3}$ to $\frac{2}{5}$ length of head. Pectoral nearly $\frac{3}{4}$ length of head. Anal II 6; second spine very strong, $\frac{1}{3}$ length of head. Caudal pointed, densely scaled. The distance between base of anal and base of caudal $2\frac{1}{3}$ depth of caudal peduncle. Scales nearly all ctenoid, 95–100 $\frac{13-14}{23-24}$; lat. l. 48–50. Uniform silvery.

Total length 450 millim.

Two specimens, from Remanso, Rio Grande, Paraguay.

This species is allied to *Sciæna surinamensis*, Blkr.

2. Geophagus duodecimspinosus, sp. n.

Depth of body $1\frac{4}{5}$ in total length, length of head 3 times. Eye nearer gill-opening than end of snout, its diameter $3\frac{1}{2}$ times in length of head and a little less than interorbital width; præorbital $1\frac{1}{3}$ diameter of eye; scales on cheek small, in 7 series. Dorsal XII 14; spines increasing in length to the fourth, which is $\frac{3}{5}$ length of head; soft portion scaly at the base, longest rays nearly as long as head. Pectoral a little longer than head. Ventral shorter, reaching anal. Anal III 9; third spine longest, as long as third dorsal. Caudal truncate. Scales $30\,\frac{4}{10}$; lat. l. $\frac{18}{9}$. Yellowish, with a dark vertical streak below the eye, and a dark round spot on the side below the lateral line; vertical fins brownish, with some small, round, white spots on the soft dorsal and anal; pectorals white, ventrals blackish.

Total length 90 millim.

A single specimen from Paraguay.

3. Euanemus nigripinnis, sp. n.

Depth of body equal to length of head, $4\frac{1}{2}$ to 5 times in total length; width of head equal to length without snout; groove extending from end of snout to occipital bone; eye as long as snout, $3\frac{2}{3}$ times in length of head, half interorbital width; maxillary barbel extending nearly to end of pectoral spine, mandibular barbels to a little beyond base of pectoral spine. Humeral process covered with skin, $\frac{1}{4}$ length of pectoral spine. Dorsal I 6; spine serrated behind, as long as head. Pectoral spine a little shorter than head. Ventral as long as pectoral, reaching a little beyond origin of anal. Anal 36–37. Caudal deeply notched. Upper surface of head, back, and a lateral stripe dark grey, rest white; pectorals and ventrals deep black, white at the base; caudal black at the base.

Total length 190 millim.

Four specimens from Paraguay.

4. Oxydoras eigenmanni, sp. n.

Both jaws with small teeth. Depth of body equal to length of head, 4 times in total length. Posterior nostril nearer the eye than to the anterior nostril; diameter of eye 4 times in length of head, $1\frac{1}{4}$ in interorbital width, $1\frac{3}{4}$ in length of snout; bases of the six barbels united by the fold of the lower jaw; maxillary barbels with smaller tentacles at the base, extending a little beyond base of pectoral spine, twice as long as mandibulars. Gill-cleft extending to below posterior border of eye. Humeral process striated, half as long as pectoral spine. Pectoral spine a little longer than the head. Dorsal I 6; spine a little shorter than the head, very strongly serrated in front, very feebly behind. Adipose fin a little shorter than base of anal. No shields between the dorsal fins. Lateral shields moderate, third vertical diameter equal to the eye, serrated behind, 26 or 27. Caudal bifurcate.

Brown above, whitish beneath; fins uniform or with small blackish spots.

Total length 80 millim.

Several specimens from Descalvados, Matto Grosso.

This species is named after Prof. C. Eigenmann, the author of the excellent Synopsis of South American Siluroid Fishes. It connects the sections *Oxydoras* and *Rhinodoras* as defined by that author, agreeing with the former in the serrature of the dorsal spine, with the latter in all other respects.

5. Callichthys pectoralis, sp. n.

Depth of body $3\frac{1}{3}$ to $3\frac{1}{2}$ times in total length. Head depressed, broader than deep, $3\frac{1}{2}$ times in total length, without bristles on the sides; diameter of eye 6 times in length of head, 4 times in interorbital width; suborbital bone narrow; occipital bone pointed in front, not reaching frontal fontanelle; inner barbels half total length. Pectoral spine $\frac{2}{3}$ length of head, covered with fine bristles, serrated on the inner side. Dorsal I 7; spine nearly $\frac{1}{2}$ length of head. Anal I 5. A pair of large pectoral plates, in contact anteriorly, or narrowly separated, their inner borders diverging behind. Shields on body reaching to base of dorsal fins, 23 above and 22 below lateral line; 3 or 4 pairs and 5 to 7 azygos shields between the two dorsal fins. Caudal rounded. Dark brown, with small blackish spots.

Total length 85 millim.

Several specimens from Monte Sociedad, Paraguayan Chaco.

This species is nearest allied to *C. thoracatus*, C. & V., and *C. longifilis*, C. & V., but differs in the larger pectoral plates, the wide separation between the frontal fontanelle and the occipital bone, and in the smaller number of anal rays.

6. Plecostomus ternetzi, sp. n.

Head as long as broad, 3 times in total length; three very obtuse keels; snout rounded, entirely granulated; diameter of eye 7 times in length of head, 4 times in length of snout, $2\frac{1}{2}$ times in interorbital width; barbel as long as diameter of eye; 44 teeth on each side in the upper jaw, and about as many in the lower jaw; interopercle with very small spines. Sides of throat, thorax, and middle of belly covered with small shields. Dorsal I 7; first ray as long as head, reaching adipose fin. Pectoral spine as long as head, strong, with small curved spines. Ventrals I 5, first ray a little shorter than head. Anal I 4. Lower caudal rays very long, as long as head, twice as long as upper. Depth of caudal peduncle $2\frac{1}{3}$ in distance between anal and caudal fins. Post-humeral keel very obtuse and short, not extending beyond base of ventral. Scutes on body rough and spinulose but not keeled; lat. l. 25; 14 scutes between the anal and caudal fins. Uniform olive above, white beneath.

Total length 240 millim.

A single specimen from Paraguay.

This species appears to be nearest allied to *P. francisci*, Lütk., which is only known to me from the description.

7. CHÆTOSTOMUS GIGAS, sp. n.

15 upper and 19 lower teeth on each side. Depth of body $4\frac{1}{2}$ times in total length, length of head $2\frac{3}{5}$ times. Head a little longer than broad, entirely rough with small spines; snout broadly rounded; diameter of eye 11 times in length of head, $4\frac{2}{3}$ times in interorbital width, 6 times in length of snout; anterior border of orbit with enlarged spinules; no postorbital groove; erectile præopercular spines very strong, the longest $2\frac{1}{2}$ diameter of orbit; barbel a little longer than diameter of orbit. Throat and belly studded with small rough shields. Dorsal I 10; all the rays rough with spinules, the first measuring $\frac{2}{3}$ length of head. Pectoral spine as long as head, covered with small spines, the longest of which are hooked and nearly equal diameter of orbit. Ventral I 5, as long as first dorsal ray. Anal I 5. Caudal obliquely truncate, lower ray longest. Shields on body rough with ridges of strong spinules, 25 in a longitudinal series. Brown, densely covered all over with round black spots.

Total length 530 millim.

A single specimen from Paraguay.

This fish, the largest known of the genus, is possibly the adult of *C. aculeatus*, Perugia, in which, however, the ventral region is entirely naked.

8. HYPOPTOPOMA GUENTHERI, sp. n.

Head not narrowed behind the eyes, its width equal to length of posterior border of orbit, its length $2\frac{3}{4}$ to 3 times in total; diameter of orbit 5 to $5\frac{1}{2}$ times in length of head, $2\frac{1}{2}$ to $2\frac{3}{4}$ times in length of snout, 3 to $3\frac{1}{2}$ times in interorbital width; barbel very small; head-shields as in *H. thoracatum*. Dorsal I 6, first ray as long as head to upper angle of gill-cleft. Pectoral as long as first dorsal ray, extending as far as ventrals, not reaching anal. Caudal deeply notched, middle rays half as long as outer. Two pairs of large, transverse pectoral shields, preceded by a transverse series of four small shields, the outer of which are in contact with the suborbital shields; three or four large ventral shields on each side, the anterior of which are usually separated by an azygos shield. Shields on body spinulose but not keeled, 20 to 22 on each side; 3 shields between the occipital and the dorsal, 12 between the dorsal and the caudal. Olive; dorsal and caudal fins with black spots, which may form two curved bands on the lower lobe of the caudal.

Total length 65 millim.

Numerous specimens from Descalvados, Matto Grosso.

The fish described and figured by Steindachner as *H. thoracatum*, Gthr., belongs to a distinct species, for which I propose the name *H. steindachneri*. His *H. bilobatum* is distinct from Cope's, which

I regard as identical with *H. thoracatum*, and is the same as that for which I propose the name *H. guentheri*. In fact 3 species are confounded under *H. thoracatum* in Dr. & Mrs. Eigenmann's Synopsis; they are distinguishable as follows:—

I. Throat entirely naked in front of the two pairs of pectoral shields; 6 to 8 pairs of ventral shields separated by a series of azygos shields; spine of adipose fin present; caudal deeply emarginate, middle rays half as long as outer . *H. thoracatus*, Gthr.

II. A transverse series of four shields in front of the pectoral shields; 3 to 7 pairs of ventral shields and a single azygos shield in front; posterior dorsal spine usually absent.

Pectoral spine not reaching origin of anal; caudal deeply emarginate, middle rays half as long as outer .... *H. guentheri*, Blgr.

Pectoral spine reaching origin of anal; caudal less deeply emarginate, middle rays much more than half as long as outer...................................... *H. steindachneri*, Blgr.

9. LORICARIA PARVA, sp. n.

Teeth small, well developed in both jaws. Head $1\frac{1}{2}$ as long as broad, $4\frac{2}{3}$ to 5 times in total length; snout obtusely pointed, feebly projecting beyond the lip; head-shields with longitudinal, spinulose striæ, without keels; diameter of orbit $5\frac{1}{2}$ to 6 times in length of head, $2\frac{1}{2}$ to $2\frac{2}{3}$ times in length of snout, $1\frac{1}{2}$ to $1\frac{2}{3}$ in interorbital width; a broad postorbital notch; lower labial fold moderately large, papillose, feebly notched, with a fringe of obtuse papillæ. Dorsal I 7; first ray $1\frac{1}{4}$ to $1\frac{1}{3}$ as long as head, just above base of ventral. Pectoral I 6, as long as head or a little shorter, reaching beyond base of ventral. Ventral I 5, as long as pectoral, reaching beyond origin of anal. Anal I 5. Outer caudal rays much produced, filiform, upper longest. Lateral scutes 26–28, with two spinose ridges approximating on the 13th or 14th; nuchal shields without keels; 16 or 17 scutes between dorsal and caudal, 14 or 15 between anal and caudal. Breast and belly shielded; pectoral shields numerous, polygonal, irregular; ventrals 7 to 9 transversely enlarged ones on each side and 3 series of small ones in the middle. All the shields spinulose and striated. Olive above, with ill-defined dark cross-bars; a dark streak on each side of the snout, from the tip to the eye; fins with dark spots.

Total length 110 millim.

Numerous specimens from Descalvados, Matto Grosso.

This species is most nearly related to *L. filamentosa*, Stdr.

10. LORICARIA LABIALIS, sp. n.

Teeth minute, rudimentary, in both jaws. Head $1\frac{2}{5}$ as long as broad, $4\frac{1}{2}$ to $4\frac{3}{4}$ times in total length; snout obtusely pointed, feebly projecting beyond the lip; head-shields rough with villose spinules, except on the edge of the end of the snout, without keels; diameter of orbit 6 to 6½ times in length of head, 3 times in length of snout, 1½ in interorbital width; a broad postorbital notch; lower labial fold moderately large in females, very large and extending to the pectoral shields in males, without notch and without fringe. Dorsal I 7; first ray nearly as long as head, just above base of ventral. Pectoral I 6, as long as head to posterior border of orbit, not reaching base of ventral. Ventral I 5, as long as pectoral, reaching origin of anal. Anal I 5. Upper caudal ray produced in a short filament. Lateral shields 30, with two spinose ridges approximating on the 21st or 22nd; nuchal shields without keels; 18 shields between dorsal and caudal, 16 between anal and caudal. Breast and belly shielded; pectoral shields numerous, polygonal, irregular; ventrals 4 to 6 transversely enlarged ones on each side, and one or two series of smaller ones in the middle. All the shields finely granulate and spinulose. Olive above; dorsal and caudal with small dark spots along the rays; pectorals and ventrals blackish.

Total length 220 millim.

Three specimens from Paraguay.

This species is allied to *L. nudirostris*, Kner, and *L. spixii*, Stdr.

11. LORICARIA APELTOGASTER, sp. n.

A few slender teeth in both jaws. Head slightly longer than broad, 5 times in total length; snout acutely pointed, feebly projecting beyond the lip; head-shields strongly spinulose; occipital shield with two closely approximated, parallel keels; diameter of orbit 7½ to 8 times in length of head, 4 times in length of snout, 1⅓ to 1½ in interorbital width; no postorbital notch; lower labial fold rather large, with long fringes; barbel long. Dorsal I 7; first ray a little longer than the head, just above base of ventral. Pectoral I 6; first ray more or less produced, at least as long as the head, reaching much beyond base of ventral. Ventral I 5; first ray produced, but shorter than pectoral, reaching much beyond origin of anal. Anal I 5. Upper caudal ray produced in a very long filament. Lateral shields 31 or 32, with two spinose ridges uniting on the 17th to 20th; nuchal shields bicarinate; 21 or 22 shields between dorsal and caudal, 19 or 20 between anal and caudal. Breast and belly naked, or with small stellate shields; a series of 6 to 8 small transverse shields may be present on each side of the belly. All the shields finely granulate and spinulose. Pale brown above, with three or four darker cross-bars on the body and two on the head; fins partially blackish.

Total length 210 millim.

Four specimens from Paraguay.

This fish is allied to *L. nudiventris*, C. & V., *L. evansii*, Blgr., and especially to *L. macrodon*, Kner.

12. TETRAGONOPTERUS TERNETZI, sp. n.

Depth of body 1¾ to 1⅘ in total length; length of head 3½ to 3⅔ times. Diameter of eye 2⅓ to 2½ times in length of head, twice length of snout, equal to interorbital width; maxillary toothless, extending to below anterior border of eye. Dorsal 11, originating behind vertical of ventrals, longest rays as long as head. Anal 40–42, deepest anteriorly, longest rays a little shorter than head. Caudal bifurcate. Scales 30–33 $\frac{7-8}{8-9}$; lateral line complete. Pale brownish, upper surface of head, dorsal, anal, and lower part of caudal region of body blackish; two blackish vertical bands on upper half of body, the first behind the head, the second below the origin of the dorsal fin.

Total length 45 millim.

Several specimens from Descalvados, Matto Grosso.

13. TETRAGONOPTERUS ULREYI, sp. n.

Depth of body $2\frac{1}{2}$ to $2\frac{3}{4}$ in total length, length of head $3\frac{1}{3}$ to $3\frac{1}{2}$ times. Diameter of eye half length of head, twice length of snout, equal to interorbital width; maxillary toothless, extending to below anterior third of eye. Dorsal 10, originating behind base of ventrals, longest rays as long as head. Anal 23–25, anterior rays elongate, a little shorter than the head. Caudal bifurcate. Scales 32–33 $\frac{6}{4}$; lateral line reduced to 8 or 9 scales. Yellowish, with a small black humeral spot, a black line along the middle of the side, and a black line along the base of the anal fin; dorsal blackish at the end.

Total length 35 millim.

Several specimens from Descalvados, Matto Grosso.

The species is named after Prof. A. B. Ulrey, the author of a very useful key to the determination of the species of this genus.

14. ANACYRTUS PROGNATHUS, sp. n.

Depth of body $2\frac{4}{5}$ in total length, length of head 4 times. Snout strongly projecting beyond the mouth, squarely truncate, with two strong tooth-like spines pointing outwards and forwards; several smaller teeth on each side of the upper jaw and two on each side of the lower; diameter of eye $\frac{1}{4}$ length of head, $1\frac{1}{2}$ in length of snout, $1\frac{1}{4}$ in interorbital width; maxillary extending to below anterior third of eye; upper profile of head very concave. Dorsal 11, equally distant from eye and base of caudal, longest rays a little shorter than head. Anal 52. Caudal deeply forked. Yellowish, with a silvery lateral stripe; end of snout and a small spot at base of caudal blackish.

Total length 125 millim.

A single specimen.

This paper will be published entire in the Society's 'Transactions,' with illustrations of the new species.

The following papers were read:—

1. An Account of the Reptiles and Batrachians collected by Dr. A. Donaldson Smith in Western Somali-land and the Galla Country. By G. A. Boulenger, F.R.S.

[Received June 11, 1895.]

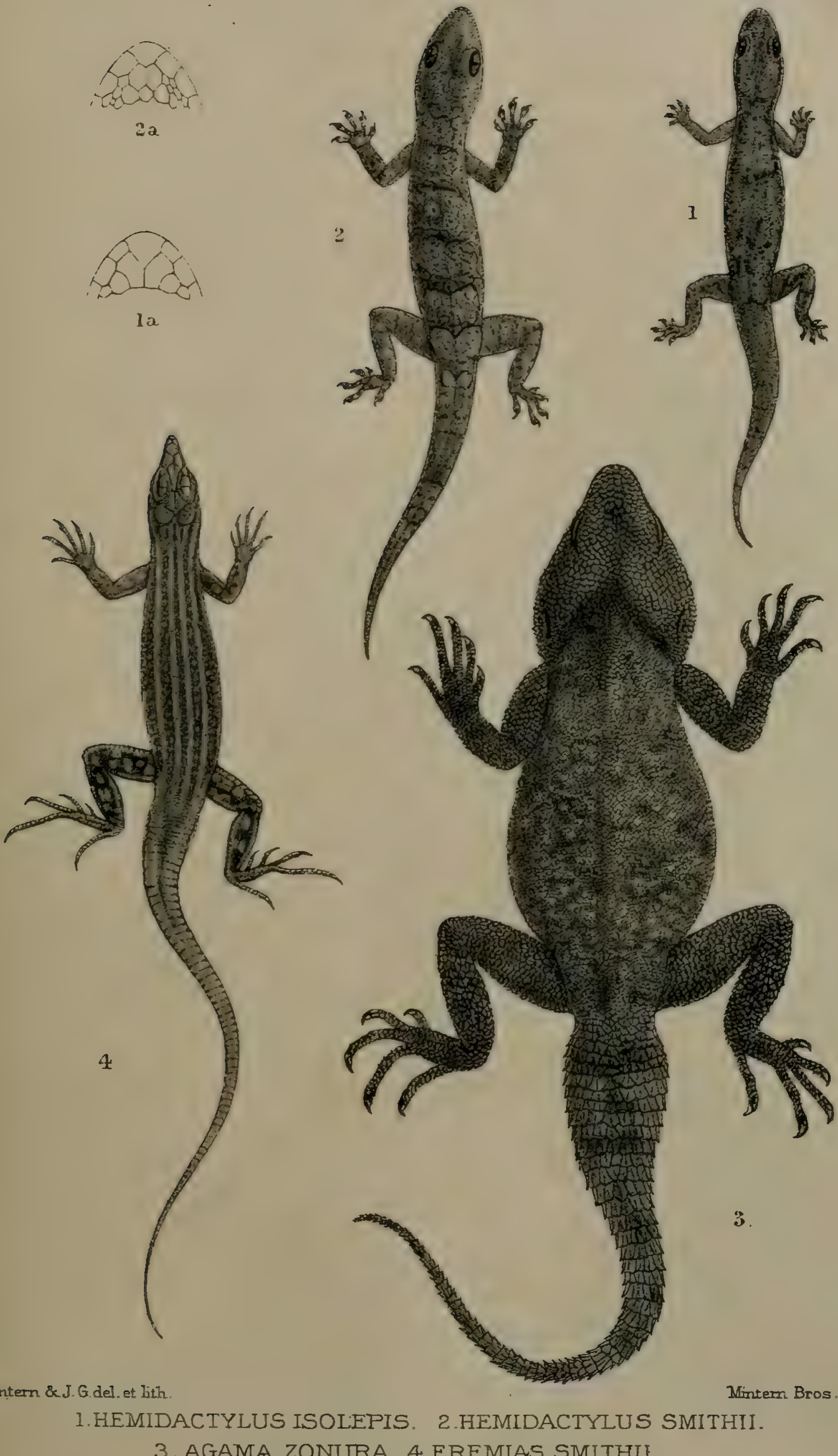
(Plates XXIX. & XXX.)

In the following pages I have given a list of all the species of Reptiles and Batrachians represented in the rich series entrusted to me for identification. Types of the new species will be presented to the British Museum by Dr. Donaldson Smith.

For an account of the route traversed by Dr. Donaldson Smith, the reader is referred to his papers and maps in the 'Geographical Journal,' iv. 1894, p. 528, and v. 1895, p. 124: also to the following papers for previous contributions dealing with the Reptiles of the region:—

1. Vaillant, L.—Reptiles et Batraciens in G. Révoil, 'Faune et Flore du Pays Çomalis.' (Paris, 1882.) 25 pp., 3 pls.
2. Mocquard, F.—"Sur une Collection de Reptiles et de Batraciens rapportés du Pays Çomalis et de Zanzibar par M. G. Révoil." Mém. Cent. Soc. Philom. 1888, pp. 109–134, pls. xi. & xii.
3. Boulenger, G. A.—"On some Reptiles collected by Signor L. Brichetti Robecchi in Somaliland." Ann. Mus. Genova, (2) xii. 1891, pp. 5–15, pl. i.
4. Boettger, O.—"Uebersicht der von Prof. C. Keller anlässlich der Ruspoli 'schen Expedition nach den Somaliländern gesammelten Reptilien und Batrachier." Zool. Anz. 1893, pp. 113–119, 129–132, & 193.
5. Boulenger, G. A.—"Esplorazione del Giuba e dei suoi Affluenti compinta del Cap. V. Bottego durante gli anni 1892–93 sotto gli auspici della Società Geographica Italiana.—Risultati Zoologici. II. Rettili e Batraci." Ann. Mus. Genova, (2) xv. 1895, pp. 9–18, pls. i.–iv.
6. Boulenger, G. A.—"On the Reptiles and Batrachians obtained by Mr. E. Lort-Phillips in Somaliland." Ann. & Mag. N. H., Aug. 1895.

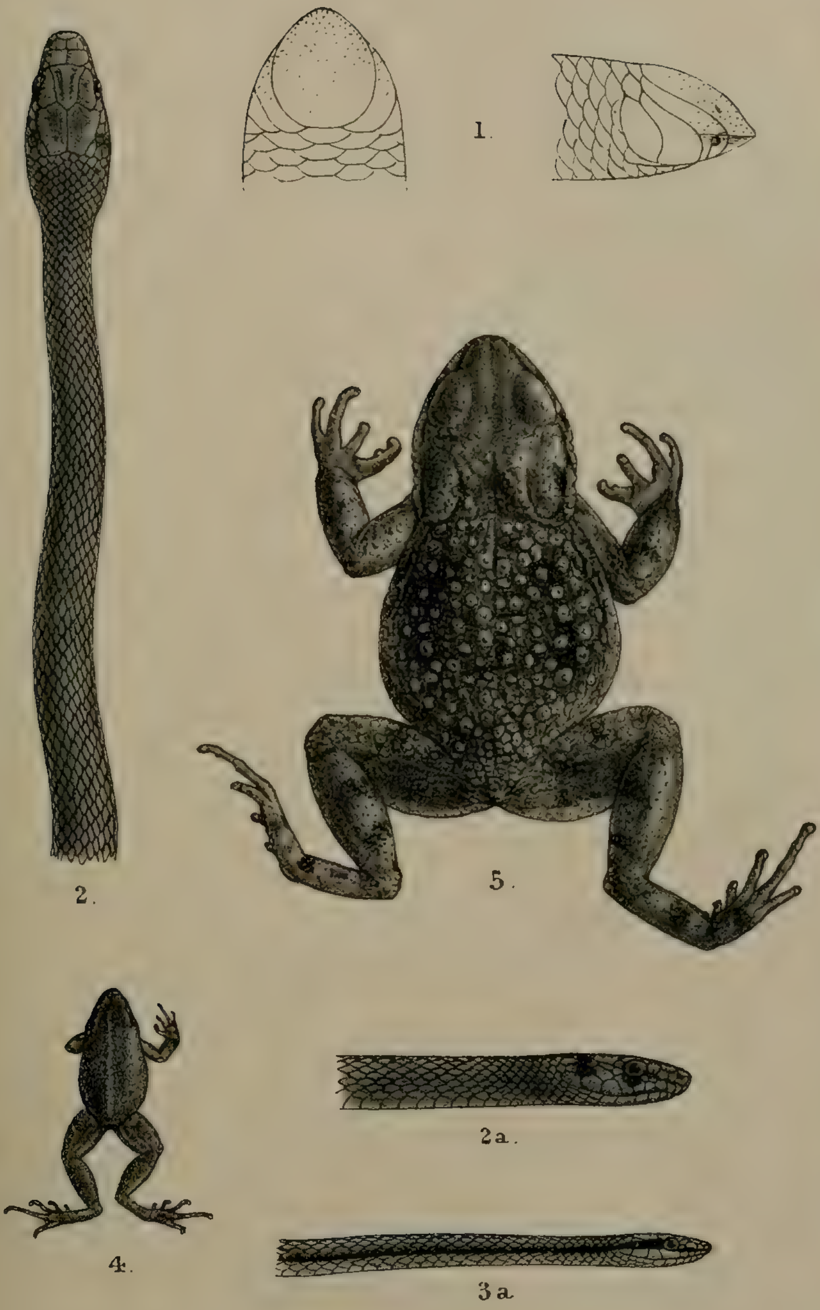
I have not in every case been able to give the locality of the specimens, as the labels are occasionally missing or only bear the date. The collection formed prior to September is from Somaliland proper, the rest from Galla, or Western Somali-land, of which district a map is given on p. 125 of the 'Geographical Journal,' vol. v. The localities are entered in conformity with those given by Dr. Bowdler Sharpe in his paper on the Birds (see above, p. 457).



R Mintern & J. G. del. et lith.
Mintern Bros. imp.

1. HEMIDACTYLUS ISOLEPIS. 2. HEMIDACTYLUS SMITHII.
3. AGAMA ZONURA. 4. EREMIAS SMITHII.

BRITISH MUSEUM Z SD NATURAL HISTORY.



R. Mintern & J. G. del. et lith.

Mintern Bros. imp.

1. TYPHLOPS SOMALICUS 2. ZAMENIS SMITHII. 3. PSAMMOPHIS PULCHER.
4. ARTHROLEPTIS MINUTUS. 5. BUFO DODSONII.

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NATURAL HISTORY.

REPTILES.

Chelonians.

1. **Pelomedusa galeata**, Schoepff.

A single young specimen (Mount Kuldush, 18.12.94). On the left side, the pectoral shield reaches the median line, whilst on the right the humeral and abdominal shields are narrowly in contact. The specimen is therefore intermediate between the typical form and *P. gehafiæ*, Rüpp.

Lizards.

2. **Pristurus flavipunctatus**, Rüpp.

Milmil, 27.7.94.

3. **Pristurus crucifer**, Val.

Between Hargeisa and Milmil, 22.7.94.

4. **Hemidactylus isolepis**, sp. n. (Plate XXIX. fig. 1.)

Head scarcely depressed, twice as long as broad; snout longer than the distance between the eye and the ear-opening; forehead with a very slight concavity; ear-opening very small, roundish. Body and limbs moderate. Digits moderately dilated, free, with rather short distal joints; 5 lamellæ under the thumb, 6 or 7 under the fourth finger, and the same number under the toes. Head covered with convex granules, largest on the snout; rostral subquadrangular, not twice as broad as deep, with median cleft above; nostril pierced between the rostral and four scales, the upper of which is largest and in contact with its fellow behind the rostral; 8 upper and 7 lower labials; symphysial large, pentagonal, twice as long as the adjacent labials; four chin-shields, median pair largest and forming a suture behind the symphysial. Body covered with equal, rounded, imbricate, smooth scales, about 65 round the middle of the body. Male with an angular series of six præanal pores. Tail cylindrical, tapering, covered with uniform scales similar to but a little larger than those on the body. Pale brown above, with dark brown irregular spots and scattered white dots; a dark brown streak on each side of the head and neck, passing through the eye.

	millim.		millim.
Total length......	78	Fore limb........	13
Head	12	Hind limb	16
Width of head....	6	Tail	38
Body	28		

A single male specimen. Turfa, 13.8.94.

This species is closely allied to *H. homœolepis*, Blanf., from Socotra (P.Z.S. 1881, p. 464), which differs in the much smaller dorsal scales, and to which specimens from Somali-land have been referred by Boettger. *H. tropidolepis*, Mocq., from Somali-land, appears, from the description, to approach *Bunocnemis modesta*, Gthr., discovered by Dr. Gregory at Ngatana, but differs in the keeled dorsal scales.

5. Hemidactylus smithii, sp. n. (Plate XXIX. fig. 2.)

Head much depressed, once and three fifths as long as broad; snout rounded, longer than the distance between the eye and the ear-opening, once and one third the diameter of the orbit: forehead concave; ear-opening small, oval, oblique. Body and limbs moderate. Digits moderate, inner well-developed; 6 or 7 lamellæ under the inner digits, 9 or 10 under the third and fourth. Head covered with granules of unequal size; rostral four-sided, nearly twice as broad as deep, with median cleft above; nostril pierced between the rostral, the first labial, and three small scales; 13 or 14 upper and 10 lower labials; symphysial triangular, broader than long, but little longer than the adjacent labials, followed by two rows of small chin-shields, two in the anterior, three in the posterior. Upper surface of body and limbs covered with small granules intermixed with moderately large, round, flat granules irregularly disposed; belly covered with imbricate, roundish, smooth scales. A series of 12 femoro-præanal pores on each side. Tail slightly depressed, tapering, with transverse series of large, smooth, flat tubercles; below with a series of transversely dilated shields. Grey above, with transverse angular cross-bars, finely edged with black behind, on the body; lower parts white.

	millim.		millim.
Total length......	86	Fore limb	17
Head	14	Hind limb	21
Width of head....	8·5	Tail	39
Body	33		

A single, half-grown specimen. Shebeli, 5.9.94.

Intermediate between *H. frenatus*, D. & B., and *H. jubensis*, Blgr.

6. Hemidactylus sinaitus, Blgr.

I refer two specimens (Boholgarshan, 4.7.94) to this species, as defined by Dr. Anderson (below, p. 639), although a series of enlarged subcaudals is present. The first labial is excluded from the nostril by a small shield. 5 lamellæ under the inner toe, 9 under the fourth. 6 præanal pores. The dorsal tubercles quite as large as in the typical *H. turcicus*.

7. Hemidactylus brookii, Gray.

Sheikh Mahomed.

This common West African Gecko was found at Wadelai by the late Emin Pasha, and in the Kibibi Basin by Dr. Gregory. It probably extends right across the Soudan.

8. Agama vaillanti, Blgr.

Dr. Donaldson Smith's collection contains three specimens of this well-marked species, recently discovered in Somali-land by Capt. Bottego. They agree well with the type in their markings, but the ground-colour of the upper parts is a pale reddish brown and the vertebral streak grey. 28 to 30 scales on the vertebral line between the origin of the fore limbs and the origin of the hind limbs, and 60 to 63 round the middle of the body.

Sassabana, 2.8.94; Shebeli, 30.12.94.

9. **AGAMA DORIÆ**, Blgr.

Sheikh Husein, 22.9.94.

10. **AGAMA CYANOGASTER**, Rüpp.

11. **AGAMA ANNECTENS**, Blanf.

Beearso, 19.12.94; Sunerdarler, 28.12.94.

12. **AGAMA ZONURA**, sp. n. (Plate XXIX. fig. 3.)

Head much depressed, triangular. Nostril lateral, not tubular, below the canthus rostralis. Head-scales very unequal in size, smooth or obtusely keeled; occipital not enlarged; a few enlarged, conical scales below and behind the ear; 11 or 12 upper and 10 or 11 lower labials; tympanum entirely exposed, larger than the eye-opening. No gular pouch. Body much depressed; above with small irregular scales intermixed with irregularly scattered, enlarged, obtusely keeled ones; no crest; ventral scales small, smooth. The adpressed hind limb reaches the ear; tibia shorter than the skull; fourth finger slightly longer than third; fourth toe very slightly longer than third, fifth extending beyond first. Tail a little longer than head and body, much depressed at the base; scales large, edged with spinules and with a small median spine, arranged in rings two of which form a well-marked segment except in the posterior third of the tail, where each segment comprises three transverse series above and two below. Male with three transverse series of anal 'pores.' Dark olive above, with some lighter dots and black marblings; blue beneath, throat and breast with a rather indistinct blackish network; anal 'pores' yellow.

	millim.		millim.
Total length......	160	Fore limb........	35
Head	19	Hind limb	48
Width of head....	19	Tail	85
Body............	56		

A single male specimen. Wardergubberner, 13.11.94.

This species is a true '*Stellio*' and connects that section of the genus *Agama* with the one of which the following species is the type.

13. **AGAMA BATILLIFERA**, Vaill.

A single female specimen, from Sassabana, measuring 76 millim.

to the vent, tail 15 (imperfect). One of the types, a male, collected by M. Révoil, is now in the British Museum.

This very curious Lizard was originally described as a *Uromastix* allied to *U. princeps*, O'Sh., which is the type of my genus *Aporoscelis*. In all respects, except the shape of the tail, it is, however, a true *Agama* and is well distinguished by its dentition from *Uromastix* and *Aporoscelis*, as was first pointed out to me by my friend Dr. Anderson.

I cannot consider the shape of the tail, in this instance, as warranting generic separation, and following the precedent laid down in dealing with the Iguanoid genera *Ctenosaura* and *Cachrys* (Proc. Zool. Soc. 1886, p. 241), and the Scincoid *Egernia* (Cat. Liz. iii. p. 134), I have no hesitation in placing *Uromastix batilliferus* in the genus *Agama*. But it may be regarded as the type of a distinct section or subgenus, for which I propose the name *Xenagama*, characterized by the extreme flattening and abbreviation of the tail.

14. VARANUS OCELLATUS, Rüpp.

Goulf, 29.11.94.

15. LATASTIA LONGICAUDATA, Reuss.

Goulf, 29.11.94.

Two specimens, male and female. 60 or 61 scales across the middle of the body. The male has 7 femoral pores on each side, the female 6.

16. EREMIAS SEXTÆNIATA, Stejneger.

The exclusion of the subocular from the lip and the absence of a light vertebral streak distinguish this Lizard from *E. spekii*, Gthr.

17. EREMIAS MUCRONATA, Blanf.

18. EREMIAS SMITHI, sp. n. (Plate XXIX. fig. 4.)

Head much depressed; snout pointed, shorter than in *E. brenneri* and *mucronata*. Upper head-shields rugose; nasals feebly swollen, lower divided, the nostril pierced between four shields; frontonasal as long as broad, separated from the rostral; two præfrontals; frontal strongly grooved; three large supraoculars, second and third forming together an oval disc surrounded with granules; a small interparietal in contact with a small occipital; an elongate shield on the outer border of the parietals; temporal scales granular, smooth; no auricular denticulation; lower eyelid scaly; subocular not reaching the lip, resting on the sixth and seventh labials; the two first labials in contact with the nasals; the two anterior pairs of chin-shields in contact. Collar curved, perfectly free, with 7 plates. Scales finely granular, juxtaposed, smooth, slightly larger on the sides, 75 across the middle of the body. 8 straight longitudinal series of ventral plates, with an outer series of smaller, imperfectly developed plates; 30 straight transverse series. Præanal region covered with small shields. The hind limb reaches the posterior border of the orbit; toes strongly compressed; foot as long as the distance between the arm and the end of the snout; one series of large and one of small subtibial scales; upper crural scales much larger than dorsals, rhomboidal, subimbricate, keeled. 19 femoral pores on each side. Back brick-red, with numerous small round white spots edged with grey, and four pale reddish-brown longitudinal streaks, the outer of which extend to the eyes; head pale reddish brown above, white on the sides; limbs brown with round pale spots; lower parts white.

	millim.		millim.
Total length	126	From end of snout to vent	46
Head	11	Fore limb	16
Width of head	7	Hind limb	32
From end of snout to fore limb	17	Tail (reproduced)	80

A single male specimen. Milmil, 27.7.94.

In the number of rows of ventral plates this *Eremias* agrees with *E. erythrosticta*, Blgr., from which it is easily distinguished by the shorter head with rugose shields.

19. MABUIA MEGALURA, Peters.

Several specimens. Sheikh Husein and Sheikh Mahomed, Sept. 94. Scales in 24 or 26 rows. Four black lines along the back (*E. massaianus*, Fischer).

20. MABUIA VARIA, Peters.

Sheikh Husein.

21. MABUIA STRIATA, Peters.

Milmil, 27.7.94.

22. LYGOSOMA MODESTUM, Gthr.

Sheikh Husein, 4.10.94.

23. LYGOSOMA SUNDEVALLII, Smith.

Two specimens, with 26 scales round the body. Sheikh Husein, 4.10.94.

24. CHALCIDES OCELLATUS, Forsk.

Berbera. A single specimen of the typical form, with 28 scales round the body.

25. CHAMÆLEON GRACILIS, Hallow.

Sibbe, 4.8.94; Smith River, 11.9.94; Sheikh Mahomed.

26. CHAMÆLEON AFFINIS, Gray.

Rokar, 11.10.94; Sheikh Mahomed, 28.10.94.

SNAKES.

27. TYPHLOPS SOMALICUS, sp. n. (Plate XXX. fig. 1.)

Snout very prominent, obtusely pointed, with sharp cutting-edge and inferior nostrils. Head-shields granulated; rostral very large, its upper portion a little longer than broad, its lower portion as broad as long; nasal completely divided, the cleft proceeding from the second labial; præocular present[1], nearly as large as the ocular, in contact with the second and third labials; ocular in contact with the third and fourth labials; eyes not distinguishable; præfrontal and supraoculars transversely enlarged. Diameter of body 90 times in total length; tail a little broader than long, ending in a small spine. 24 scales round the body. Pale olive, head yellowish.

Total length 450 millim.

A single specimen, Beearso, 19.12.94.

Most nearly allied to *T. crossi*, Blgr., from the Lower Niger.

28. BOODON LINEATUS, D. & B.

Three specimens. Sheikh Husein, 25.9.94; between Fehja and Tooloo, 24.11.94.

The largest, a male, has two præoculars on the left side and one on the right, and 27 scales across the body. The two others, young, have a single præocular and 29 and 31 scales respectively.

29. LYCOPHIDIUM ABYSSINICUM, Blgr.

Sheikh Husein, 8.10.94.

A single specimen, 185 millim. long. Ventrals 203; subcaudals 31.

30. ZAMENIS SMITHI, sp. n. (Plate XXX. fig. 2.)

Snout obtuse, feebly projecting. Rostral once and a half as broad as deep, the portion visible from above measuring one fourth its distance from the frontal; internasals as long as the præfrontal; frontal broader than the supraocular, once and two fifths as long as broad, longer than its distance from the end of the snout, shorter than the parietals; loreal longer than deep; one præocular, in contact with the frontal, with one or two suboculars below it; two postoculars; temporals 2+2; nine (exceptionally ten) upper labials, fifth and sixth (or sixth and seventh) entering the eye; four or five lower labials in contact with the anterior chin-shields; posterior chin-shields as long as or longer than the anterior and separated from each other by two series of scales. Scales smooth, in 21 rows. Ventrals very obtusely angulate laterally, 180–185; anal divided; subcaudals 100. Uniform pale buff above, pinkish on the sides; a greyish blotch below the eye and another across the temple; white beneath.

Total length 560 millim.; tail 170.

Two specimens, male (V. 180; C. 100) and female (V. 185; C. ?). Shebeli, 23.8.94; 16.1.95.

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[1] Absent on the left side, by anomalous fusion.

Intermediate between *Z. florulentus*, Geoffr. (Sc. 21; V. 201–228; C. 82–100), and *Z. brevis*, Blgr. (Sc. 19; V. 159; C. 76).

31. AMPLORHINUS NOTOTÆNIA, Gthr.

A single specimen, in bad condition.

32. HEMIRHAGERRHIS KELLERI, Bttgr.

A single female specimen. Sunerdarler, 28.12.94.
Sc. 17; V. 153; A. 2; C. 73.

33. PSAMMOPHIS SIBILANS, L.

Two specimens. Sheikh Husein, 8.10.94.

Like the typical form from Egypt, but without longitudinal lines on the body; head with the yellowish, black-edged markings well-defined; each upper labial with a brown spot; lower third of outer row of scales white. V. 161, 168; C. 106, ?.

34. PSAMMOPHIS PUNCTULATUS, D. & B.

Turfa, 21.8.94.

A single male specimen, agreeing with the one recently figured in Ann. Mus. Genova, (2) xv. pl. iv.

Head reddish above. 8 upper labials on the right side (fourth and fifth entering the eye), 9 on the left. V. 180; C. 156.

35. PSAMMOPHIS BISERIATUS, Ptrs.

Four specimens. Shebeyli, 5.9.94; Turfa, 24.12.94.
Ventrals 147–164; anal divided; subcaudals 100–103.

36. PSAMMOPHIS PULCHER, sp. n. (Plate XXX. fig. 3.)

Snout once and two thirds as long as the eye. Rostral broader than deep, visible from above; nostril between two shields; internasals much shorter than the præfrontals; frontal twice and a half as long as broad, a little narrower than the supraocular, longer than its distance from the end of the snout, nearly as long as the parietals; loreal once and two thirds as long as deep; two præoculars, upper not reaching the frontal; two postoculars; temporals 1+2; eight upper labials, third deeper than fourth, fourth and fifth entering the eye, fifth as long as the eye; four lower labials in contact with the anterior chin-shields, which are a little shorter than the posterior. Scales in 13 rows. Ventrals 144; anal divided; subcaudals 108. Pale brownish above, with an orange black-edged vertebral stripe and a black lateral streak, running along the second row of scales and extending to the end of the snout after passing through the eye; upper lip, outer row of scales, and outer ends of ventrals white; ventrals yellow in the middle, with an orange line on each side.

Total length 435 millim.; tail 160.

A single female specimen. Webi Shebeli, 24.12.94.

This species fills up the gap between *P. biseriatus*, Ptrs., and *P. angolensis*, Bocage. It is therefore a highly interesting addition to our knowledge of this genus. I am now able to define 17 species, for the determination of which the following synopsis has been prepared:—

Synopsis of the Species of Psammophis.

I. Scales in 17 rows, exceptionally 19.

A. Rostral a little broader than deep, well visible from above.

1. Anal entire; eight upper labials, fourth and fifth entering the eye.

One præocular; five lower labials in contact with the anterior chin-shields; ventrals 170–185; subcaudals 92–97 .... 1. *leithii*, Gthr.

Two præoculars; four lower labials in contact with the anterior chin-shields; ventrals 157–171; subcaudals 81–104 .... 2. *notostictus*, Ptrs.

2. Anal divided.

a. Five or six lower labials in contact with the anterior chin-shields; usually nine upper labials, fifth and sixth entering the eye; præocular in contact with the frontal; ventrals 162–197.

Sixth upper labial shorter than the eye, which is more than half the length of the snout; subcaudals 93–149 .... 3. *lachrymans*, Reuss.

Sixth (exceptionally fifth) upper labial as long as the eye, which is more than half the length of the snout; subcaudals 130–158 .... 4. *punctulatus*, D. & B.

Sixth upper labial as long as the eye, which is half the length of the snout; subcaudals 132 .... 5. *trigrammus*, Gthr.

b. Four lower labials in contact with the anterior chin-shields; eight or nine upper labials; ventrals 151–168; subcaudals 100–108 .... 6. *subtæniatus*, Ptrs.

B. Rostral as deep as broad, well visible from above.

1. Nine upper labials, three entering the eye; ventrals 161–173; subcaudals 109–127... 7. *bocagii*, sp. n. (Angola).

2. Eight upper labials, exceptionally seven or nine, two entering the eye.

a. Frontal, in the middle, narrower than the supraocular; ventrals 157–198; subcaudals 90–116.

Præocular narrowly in contact with or separated from the frontal, which is as long as or longer than its distance from the end of the snout...... 8. *sibilans*, L.

Præocular extensively in contact with the frontal; snout short, forehead strongly grooved........... 9. *furcatus*, Ptrs.

Præocular separated from the frontal, which is considerably shorter than its distance from the end of the snout .... 10. *longifrons*, Blgr.

b. Frontal, in the middle, nearly as broad as the supraocular; præocular not reaching the frontal.

Snout nearly twice as long as the eye; ventrals 156–182; subcaudals 75–90 .... 11. *condanarus*, Merr.

Snout once and a half to once and two thirds as long as the eye; ventrals 153–163; subcaudals 64–95 .... 12. *brevirostris*, Ptrs.

C. Rostral a little broader than deep, scarcely visible from above; snout twice to twice and a half as long as the eye; nine upper labials, fifth and sixth entering the eye; ventrals 179–202; subcaudals 144–161...... 13. *elegans*, Shaw.

II. Scales in 15 rows.

Nine or ten upper labials (rarely eight); ventrals 142–164; subcaudals 100–131 .... 14. *biseriatus*, Ptrs.

Eight upper labials (rarely seven); ventrals 136–155; subcaudals 62–81 .... 15. *crucifer*, Daud.

III. Scales in 13 rows; ventrals 144; subcaudals 108... 16. *pulcher*, sp. n.

IV. Scales in 11 rows; ventrals 141–155; subcaudals 57–81 .... 17. *angolensis*, Bocage.

37. Rhamphiophis oxyrhynchus, Reinh.

Two specimens. Booree, 27.11.94.
V. 171, 170; C. ?, 109.

38. Causus rhombeatus, Licht.

Two specimens. Sheikh Husein, 16.9.94; Durro, 2.12.94.
Sc. 20; V. 158, 166; C. 27, 25.

39. Atractaspis microlepidota, Gthr.

A single female specimen. Tooroo, 5.1.95.
Sc. 31; V. 252; A. 1; C. 28, single.

BATRACHIANS.

1. Rana delalandii, D. & B.

Tuago, 27.10.94; Webi Shebeli, 24.12.94; Sheikh Husein, 25.9.94.

2. Rana mascareniensis, D. & B.

Tooroo, 5.1.95; 16.1.95.

3. Arthroleptis minutus, sp. n. (Plate XXX. fig. 4.)

Tongue with a free papilla in the middle. Head moderate, as long as broad; snout rounded, a little shorter than the diameter of the orbit; canthus rostralis rounded; tympanum hidden. Fingers and toes blunt; first finger shorter than second; toes webbed at the base, the web extending as a fringe to the tip; a tarsal tubercle; a small, oval inner metatarsal tubercle; subarticular tubercles strong. The tibio-tarsal articulation reaches the posterior border of the eye. Skin smooth. Blackish brown above, whitish beneath; a fine whitish vertebral line. Male with a subgular vocal sac.

From snout to vent 16 millim.

A single male specimen. Durro, 2.12.94.

4. CHIROMANTIS PETERSII, Blgr.

A fine female specimen, measuring 80 millim. from snout to vent. Darar, 15.9.94.

5. CASSINA OBSCURA, Blgr.

A single specimen from the Budda Plateau.

The tarso-metatarsal articulation reaches the shoulder. Toes one-third webbed. Skin nearly smooth above. Olive-green above, with dark liver-brown spots.

6. CACOSTERNUM NANUM, Blgr.

A single specimen. Durro, 2.12.94.

The occurrence so far north of this species, originally described from Caffraria (Ann. & Mag. N. H. [5] xx. 1887, p. 61), is surprising. Yet I have little doubt the determination is correct.

7. BUFO REGULARIS, Reuss.

Numerous; collected all along the route.

8. BUFO DODSONI, sp. n. (Plate XXX. fig. 5.)

Crown without bony ridges; snout short, blunt; interorbital space as broad as the upper eyelid; tympanum very distinct, two thirds the diameter of the eye. First finger considerably longer than second; toes one-third webbed, with single subarticular tubercles; two moderate metatarsal tubercles; a tarsal fold. The tarso-metatarsal articulation reaches the anterior border of the eye. Upper parts with numerous flat, distinctly porous warts; parotoids oval, flat, as long as their distance from the anterior border of the orbit. Pale olive above, with small darker spots; a dark canthal streak and a dark vertical bar below the eye; lower parts white. Male with an internal subgular vocal sac.

From snout to vent 53 millim.

A single male specimen. Rassa Alla, 6.10.94.

This species, which is allied to *B. viridis*, Laur., is named after Mr. E. Dodson, who accompanied Dr. Donaldson Smith as taxidermist.

9. XENOPUS MUELLERI, Ptrs.

Murgen (Salro), 12.11.94.

EXPLANATION OF THE PLATES.

PLATE XXIX.

Fig. 1. *Hemidactylus isolepis*, p. 531. 1 *a*. Chin-shields, × 3.
2. *Hemidactylus smithi*, p. 532. 2 *a*. Chin-shields, × 3.
3. *Agama zonura*, p. 533.
4. *Eremias smithi*, p. 534.

PLATE XXX.

Fig. 1. *Typhlops somalicus*, p. 536. Upper and side views of head, × 3
2. *Zamenis smithi*, p. 536. 2 *a*. Side view of head.
3. *Psammophis pulcher*, p. 537. 3 *a*. Side view of head.
4. *Arthroleptis minutus*, p. 539.
5. *Bufo dodsonii*, p. 540.

2. On the Moulting of the Great Bird of Paradise, with brief Notes upon its Habits in Captivity. By Ram Bramha Sányál, C.M.Z.S.

[Received May 27, 1895.]

In his remarks on the moulting of the Great Bird of Paradise (*Paradisea apoda*), recorded in the P. Z. S. of April 1887 (p. 392), Mr. Bartlett questions the statement of Dr. Guillemard, made upon the authority of the inhabitants of the Aru Islands, that the Great Bird of Paradise "does not wear its adult plumage all the year, and that its beautiful plumes remain developed for not longer than two or three months."

I have had opportunities of observing the habits of two adult males of the Great Bird of Paradise for a sufficient length of time to justify me in stating that, although it is difficult to make the phenomenon fit in with our previous notion of the law of moulting in birds, it is nevertheless the fact that my observations regarding the moulting of this bird, extending over a period of four years, go to show that there is some truth in Dr. Guillemard's statement.

In January 1891, the Zoological Garden, Calcutta, was fortunate in having presented to it a male *Paradisea apoda*, from the Aru Islands. It was then in perfect adult plumage. By the middle of February following I noticed that the bird was every now and then pecking at the feathers of its lower back, which was much dishevelled. Suspecting something wrong, I consulted Mr. William Rutledge, an experienced dealer in live stock at Calcutta, who had owned the bird for about two years previous to its acquisition by the Garden. He assured me that there was nothing wrong, but that the bird was beginning to moult. It went on throwing off its feathers slowly at first, but rapidly as the period of moult advanced, so that by the middle of May it had cast off all its beautiful side-plumes and tail-feathers, except the two central wire-like ones, which fell off later on. The short, close, velvety feathers of the head, neck, and throat were the last to fall off by the end of July, and the first to reappear a few days later. The bird did not, however, assume its perfect plumage until about the middle of October. With slight variations as to time, it has, every year since its arrival in 1891, been observed to remain more or less in undress, as it were, during the unusually prolonged period of moulting. During the current year it began throwing off its feathers early in February, and now (May 7th) not one of the long beautiful plumes is left. The two long wire-like central tail-feathers have not fallen, but are broken off at the middle.

In January 1892, another male bird of the same species, but said to have been from the southern part of New Guinea (and possibly, therefore, referable to *P. papuensis*), was acquired by purchase. It was slightly smaller and a little brighter in colour than the Aru-Island bird. During the two years that it remained alive its moulting-habits were carefully observed and found to vary somewhat from the other bird. Briefly speaking, it did not begin throwing off its feathers until the summer was somewhat advanced, and took less time to complete its moult than the Aru-Island bird.

Habits in captivity.—Besides being active and vigorous, as stated by Wallace, the Great Bird of Paradise is amusing and demonstrative, possessing many of the characteristics of a Magpie and Bhimraj (*Dissemurus paradiseus*), but is liable to be stupid and helpless when the economy of its ordinary mode of life is in any way disturbed. At least such has been observed to be the case with the Aru-Island bird. It behaved in a very strangely stupid manner when let out in a large and lofty aviary a few days after its arrival. Perhaps the vastness of the place bewildered and frightened it. It, however, recovered its equanimity shortly after being placed in its old and accustomed cage. It is very fond of dancing, but want of company evidently acts as a check upon this passion. It has a loud and deep note, which it constantly utters with infinite variation and modulation. It maintains excellent health upon diet consisting of a teacupful of bread and milk in the morning, half a papya-fruit in the forenoon, and a few grasshoppers or cockroaches the last thing in the afternoon. Its low subdued chuckles and grunts while taking the insects from off the fingers of the keeper clearly show its great insectivorous propensity. It very much enjoys a shower-bath, administered by a garden syringe, twice a week during summer. The smaller bird (said to have been from the southern part of New Guinea) was less demonstrative; but this might have been its individual peculiarity.

3. On the Mammals of Aden.

By Col. J. W. Yerbury and Oldfield Thomas.

[Received May 29, 1895.]

The present paper is based on the collections made by Yerbury at and near Aden in February and March of this year, and, as there has been remarkably little recorded about the mammals of this southern point of Arabia, we have added to the list two species not represented in the collection, but mentioned by other authors, and have thus made the paper contain a complete list of the mammals as yet known to occur in the district of Aden.

The only two papers that we know of mentioning Aden mammals are:—

(1) Monticelli, F. S. "Note Chirotterologiche."[1] (1887.) [Description of *Vespertilio dogalensis*, and record from Aden of *Hipposiderus tridens*, *Nycteris thebaica*, *Rhinopoma microphyllum*, and *Xantharpyia straminea*.]

(2) Matschie, P. "Ueber einige von Herrn Oscar Neumann bei Aden gesammelte und beobachtete Säugethiere."[2] (1893.) [Notice of *Papio hamadryas*, *Xantharpyia straminea*, *Scotophilus schlieffeni*, and *Hystrix* "*africæ-australis*."]

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[1] Ann. Mus. Genov. (2) v. p. 517.

[2] SB. Ges. nat. Freund. 1893, p. 24.

Examples of all the above-mentioned animals were collected by Yerbury, with the exception of the Baboon and Monticelli's new Bat, *Vespertilio dogalensis*; and he also obtained or observed examples of 29 additional species, bringing up the total to 36, a number which is more than could have been expected from so barren a place.

Of these additional species four are Gerbilles, all of which, to our surprise, prove to be quite distinct from any species found elsewhere, and have therefore had to be described as new.

On the whole, judging by the numbers of specimens of each sort brought home. we think it probable that there are not many more terrestrial species to be obtained at Aden, however many Bats or marine mammals may hereafter be found to occur there. At the same time, Yerbury believes that a second Fox and a second Hare are to be found in the district, while, as will be seen below, several animals, of the existence of which he has certain personal knowledge, escaped capture during his last visit.

The following account of the localities is contributed by Yerbury:—

The peninsula of Aden is situated in lat. 12° 47′ N. and long. 44° 59′ E., and is, roughly speaking, five miles in its greatest length and three miles in breadth. The centre of the peninsula is formed by the Shum Shum Range, the highest peak of which rises to 1760 feet. From this range spurs run down to the sea, with deep ravines between them ending at the sea in sandy beaches. On the north side an elevated plateau lies between this range and the cantonment of Aden (the Crater); this plateau being deeply cut by watercourses, the greater number of which form the feeding-channels supplying the tanks. The peninsula is united to the mainland by a low, sandy, barren isthmus, about two miles long by three-quarters of a mile broad.

Near Shaik Othman, five miles from the Barrier Gate, the aspect of the country alters slightly, the plain being covered with salsola bushes, while round Shaik Othman itself a considerable amount of cultivation has sprung up in the last few years. Onwards inland the plain continues with some stunted salsola, baubal, and caper bushes—in a few places the baubals having grown into good-sized trees; and so with a few rolling sand-hills here and there the plain runs on until the outskirts of cultivation round Al Hautah (Lahej) are reached, about sixteen miles from the Barrier Gate. About three miles beyond this point the town of Al Hautah is arrived at, while eight miles beyond Al Hautah is Haithalhim, with the remains of an old garden; close by the river bifurcates, and it is between the branches of this fork that the bulk of the cultivation lies.

This oasis is very fertile and produces jowari, Indian corn, telli, and other crops; there are, too, a few gardens with almond, cocoanut, and other trees, and several groves of date-palms. From near Haithalhim to Zaidah (six miles) the river runs in a single bed; there is always water in this part of the river (though in dry seasons the water loses itself in both branches close to Haithalhim). There is a good deal of cultivation in the bed, but the greater part of it is choked up with a growth of gigantic reeds. Away from the bed of the river the country on both sides is an absolute desert. About eight miles beyond Zaidah the outlying spurs of the mountains are reached. The rise of the land between the Barrier Gate and Zaidah is probably under 100 feet; the cliffs at Haithalhim and other places are quite 40 feet high, showing that the river has cut itself a bed to this depth in the soft soil.

The places collected at were Aden, Shaik Othman, Lahej, and Haithalhim, and all these places may be considered of the same altitude. Aden itself, *i. e.* the peninsula, is entirely composed of volcanic rock. The mammals are Monkeys, Foxes, an occasional Jackal, two species of Rat, a spiny Mouse, two species of Shrew, several species of Bat, and probably the Common Mouse, the Musk-Rat, and a species of Bandicoot. The greater part of the maritime plain inland has been at some period under the sea, but round Lahej a great amount of detritus brought down by the river has been deposited. The Arabic names of the various mammals met with are as follows:—

Monkey: *rubba.*
Fruit Bats: *sir*, or, perhaps nearer, the "Zumerset" *zurr.*
Nycteris thebaica: *choef*, probably applied to all small Bats.
Fox: *darain*; occasionally *taleb.*
Hare: *ărnub.*
Hyena: *dhĕb.*
Porcupine: *gendebah.*
Gazelle: *dobbi.*
Ibex: *weàl.*

One other place may be worthy of notice, and that is the island in Ras Fakoum Bay beyond Little Aden. On this island is a large cavern, large enough to admit a ship's gig, which swarms with Bats. Three species were obtained there—*Coleura afra* in small colonies by themselves, and *Hipposideros tridens* and *Triænops persicus* mixed up together. As the cave is lofty, all specimens have to be shot, and the walls of the cave rising straight out of the sea the specimens when shot fall into the water; this of course does not improve them as such.

One word as to the names of places visited: the name of the Arab town inland from Aden is Al Hautah, while the name Lahej appears applicable to the whole of the territory of the Abdali Tribe; but as it is always customary to talk of the town as Lahej, we have done so here.

All the specimens mentioned in this paper have been presented to the British Museum.

The determination of Arabian mammals presents in some ways unusual difficulty, owing to the fact that the Indian and African faunas meet here, and that species described from each, without reference to the other, often prove to be unexpectedly similar. Arabian animals may therefore often be apparently with equal reason assigned to one or other of two forms usually supposed to be quite distinct.

This very difficulty, however, renders the present collection all the more valuable as an aid to future workers on the subject.

It may be noted that only two terrestrial non-volant species can be said to be distinctly African, namely, *Papio hamadryas* and *Arvicanthis variegatus*, while the same number (*Hystrix leucura* and, if correctly determined, *Gazella bennetti*) are Indian. The Bats are nearly wholly African.

1. Papio hamadryas (L.).

The Aden Monkey is recorded under this head by Matschie. No specimen was brought home by Yerbury, but one was seen at Haithalhim in March. In Aden itself the Lascars at the signal-station on the Shum Shum Range stated that a flock of 12 or 13 individuals frequented the crest of the ridge. Monkeys were heard near the last locality but not seen.

2. Xantharpyia straminea, Geoffr.

a–e. 5 specimens. Lahej.

These Bats were plentiful in the Sultan's garden at Lahej on the occasion of the first visit on March 5: they frequent the tops of the tallest palm-trees, where they collect in large ball-like clusters, but are by no means easy to see; in fact, were it not for the characteristic Flying Fox chattering that they keep up incessantly they would probably be overlooked altogether. After being shot at on the above-mentioned date the bulk disappeared and only one or two stray specimens were seen up to date of departure from Lahej at the end of the month.

3. Xantharpyia ægyptiaca, Geoffr.

a–i. 9 specimens. Lahej. 21–29. III. 95.

In great numbers in a cave on the banks of the Wady Jughur near Lahej. A female, killed on the 29th, had a single young one at her breast, and other gravid females had single fœtuses only.

We use the name *ægyptiaca* provisionally, as there does not seem to be any tangible difference between these specimens and examples from Egypt; but the proper relationships of and differences between *X. ægyptiaca*, *X. amplexicaudata*, and *X. collaris* much need investigation with larger material.

4. Triænops persicus (Dobson).

a–e. Cave on island in Ras Fakoum Bay (Little Aden). 6. IV. 95.

In great numbers at this locality on the above date. There were a few foxy-red specimens (one of which was obtained) to be seen among the others.

As to the cause of the foxy colour observable in certain individuals we are quite unable to make any suggestion. All the specimens are males, and the one red individual does not appear to differ from the others in age or in the development either of its facial glands or reproductive organs[1].

5. HIPPOSIDERUS TRIDENS, Geoffr.

a, b. Lahej. 3 and 27. III. 95.
c–l. Island in Ras Fakoum Bay, in cave. 6. IV. 95.

Although only two specimens of this Bat were obtained at Lahej it does not appear to be uncommon there. At the second locality it was very plentiful. Each gravid female contained a single fœtus.

6. NYCTERIS THEBAICA, Geoffr.

a–f. Lahej. 3. III. 95.
g. Lahej. 6. III. 95.
h–k. Lahej. 18. III. 95.

This Bat was very plentiful in the bungalow at Lahej, and could always be caught during the small hours of the night in the bath-room with a butterfly-net. They fed on various species of orthoptera, a great number of wings of locusts and grasshoppers being littered about the floor below where they had been hanging to the rafters of the bath-room. This is an early flying Bat and follows (at Lahej) *H. tridens* soon after dusk. As usual, the gravid females had each only a single fœtus.

7. SCOTOPHILUS SCHLIEFFENI, Peters.

a, b. Lahej. 12. III. 95.

Three of these Bats came into the bungalow at Lahej about 8 P.M. on the above date, two of which were caught in the butterfly-net. This was the only occasion the species was met with.

In using the word *Scotophilus* we provisionaly accept the opinion of Dr. Harrison Allen as to the distinctness from each other of the American and Old World members of the group, to which if united the name *Nycticejus* would apply.

8. VESPERTILIO (LEUCONOË) DOGALENSIS, Monticelli.

No specimens of this Bat were met with, nor in fact any representatives of the great genera *Vesperugo* or *Vespertilio*, in both of which the whole Arabian region seems to be singularly poor.

9. COLEURA AFRA (Peters).

a, b. Cave in island Ras Fakoum Bay (Little Aden). 6. IV. 95.
c–j. Cave at Aden. 13. IV. 95.

A few of these Bats were found in the first of these localities—a lofty cave with direct communication with the sea, and with deep water everywhere. Although a great number of *Triænops persicus* and *Hipposiderus tridens* were also found in the same cave, this

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[1] Compare J. A. Allen, Bull. Am. Mus. N. H. vi. p. 248 (1892), where a parallel variation in *Chilonycteris davyi* is shown to be "independent of sex, age, or season."

Bat kept itself entirely separate from them. The second locality was also a cave near sea-level, but, although communicating with the sea, its general level was above high-water mark; here *C. afra* was in considerable numbers, and was apparently the only species present. Each gravid female had, as usual, only a single fœtus.

10. TAPHOZOUS PERFORATUS, Geoffr.

a. Lahej. 22. III. 95.
b. ♀. Lahej. 29. III. 95.

These two specimens were obtained in the same cave as *Xantharpyia ægyptiaca*. Only these two species were seen in this cave, or, rather, tunnel, where a stream from the cultivated lands above to the bed of the Wady below had first cut and then burrowed its way underground.

Specimen *b* contained a single fœtus.

11. RHINOPOMA MICROPHYLLUM, Geoffr.

a. ♀? Aden. 9. IV. 95. In small cave alone.

This was the only specimen met with, although four or five Bats had been reported to have been seen in the cave (up among the rocks) a day or two previous.

12. CROCIDURA RUSSULA (Herm.).

a. Aden. 1885.

This Shrew, collected and presented to the Museum by Yerbury in 1885, was examined and identified as "*Crocidura aranea*" by Dr. Dobson—an identification which we provisionally accept, although not without some doubts on the subject.

We apply to this species the name *russula* instead of *aranea*, for the reasons set forth by Thomas in the 'Zoologist' for 1895[1].

13. CROCIDURA (PACHYURA) ETRUSCA, Savi.

a. Aden. 1884.
b. Lahej. 17. III. 95.

This determination, like the last, is that of Dr. Dobson, in whose writing the 1884 specimen is labelled.

14. ERINACEUS, sp. inc.

A Hedgehog is sometimes to be seen for sale in Aden, but the inhabitants of the neighbourhood of Lahej do not seem to know the animal; it appears probable, therefore, that these specimens have been brought either from the Somali coast or from the neighbourhood of Makullah to the N.E. of Aden.

15. FELIS MANICULATA, Rüpp.

a. ♂. Domesticated. Aden. 18. II. 95.
b. Neighbourhood of Daraimia, shot by Mr. C. Chevallier, Eastern Telegraph Co.

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[1] P. 62.

This is probably the Cat occasionally seen near the edge of the desert. When Yerbury was shooting Sand-Grouse in the neighbourhood of Shulaif, in company with Mr. Chevallier, the latter said that he had fired at a large Cat, but had not bagged it.

16. Felis caracal, Güld.

Two specimens of this Lynx are known to be have been obtained in the neighbourhood of Aden: one is in the possession of Mr. Chevallier, and was shot by him near Haithalhim in the year 1884 or 1885; the other was obtained later on by another *employé* of the Telegraph Company, but exactly when and where was not recorded.

17. Herpestes, sp. inc. (probably *H. albicauda*, Cuv.).

A Mungoose was seen at Haithalhim. The white-tailed species has been recorded by Thomas from Muscat, and no doubt occurs at Aden.

18. Hyæna hyæna, Linn.

A Striped Hyæna was brought into Aden from the neighbourhood of Bir Ahmed, and was seen by Mr. C. Chevallier. Hyænas are reported to have been seen in the neighbourhood of Camp Aden; but this is the only authenticated record of its existence that is forthcoming.

19. Canis aureus, Linn. (or *anthus*, Geoffr.).

A Jackal is without doubt to be found in the neighbourhood: one was seen near the Municipal bungalow at Shaik Othman, and another in Aden itself near the Isthmus position.

20. Vulpes nilotica, Geoffr. (?)

a, b. ♂ ♀. Shaik Othman. 5. IV. 95.

The form obtained appears to be the common one in Aden itself and round the isthmus, that seen in the desert being altogether a brighter coloured animal.

In the present somewhat chaotic state of our knowledge of Foxes we do not venture to assign these specimens positively to *V. nilotica* or any other species; but there seems to be so little difference between them and Egyptian examples, that we propose to use this name for the present. We may note that some at least of the specimens from Muscat, determined by Thomas[1] as *V. leucopus*, Bly., are really the same as the present comparatively large animal; while others, again, agree very closely with Rajputana examples of Blyth's species, as Blanford has pointed out[2].

Yerbury saw at Daraimia an individual of what he believed to be a second species of Fox, but was unable to procure a specimen. Perhaps this will prove to be the true *V. leucopus*.

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[1] P. Z. S. 1894, p. 450.

[2] Mamm. Brit. Ind. p. 152 (1888).

21. Gerbillus (Dipodillus) pœcilops, sp. n.

a–c. Lahej. 20–29. III. 95.
d–g. Shaik Othman. 2–3. IV. 95.

Size medium among Gerbilles in general; trunk larger than in *G. campestris*; but ears, feet, and tail shorter, the feet especially bearing to the size of the head and body the proportion found in *Mus* rather than *Gerbillus.* Fur short, soft, and sleek. General colour rich fawn, rather greyer on the back, brighter on the sides. Face with the usual supraorbital and post-auricular white patches very prominent; white of the lips and chin ascending on the cheeks nearly to the lower eyelid. On the top of the nose a distinct black patch. Ears very small and narrow, laid forwards in a spirit-specimen they only just reach to the posterior canthus of the eye; the anterior half of their outer surfaces thinly haired. fawn, the remainder naked; a large naked patch on the sides of the head behind and below their outer bases. Under surface, whole of fore limbs, front of hind limbs, and top of feet pure white. Palms as usual in the subgenus. Soles wholly naked, granulated distally, with six pads, as in typical *Dipodillus*, but the two proximal pads exceedingly small. Tail short, little, if at all, longer than the head and body; the hairs of its upper surface brown or black, not or scarcely elongated terminally, of its sides and lower surface white.

Skull strongly built, with heavy overhanging supraorbital ridges, somewhat like those of many Meriones, and forming rudimentary postorbital processes. Bullæ rather large, about as in average specimens of "*Hendecapleura*." Molars small and delicate.

Dimensions of an adult male, preserved in spirit:—

Head and body 107 millim.; tail 109; hind foot 23·5; ear 11 × 7·7.

Skull (of the type): basal length 26·2; greatest length in middle line 30·5; zygomatic breadth (c.) 17·2; nasals 11·5 × 3·4; interorbital breadth 5·9; tip to tip of postorbital processes 10·3; interparietal 3·3 × 6·8; palate length from henselion 14; diastema 8·5; palatal foramina 4·5; upper molar series 3·6; greatest oblique diameter of bullæ 11.

Type. Skin *c.* B. M. No. 95.6.1.64.

This species differs so widely from all others known to us that we are unable to say what is its nearest ally. Its unusual proportions, its short ears, feet, and tail, compared with its heavy head and body, render it quite unlike the ordinary graceful Gerbilles. It will be seen from the measurements that the hind foot is actually shorter than the basal length of the skull, while in all other Gerbilles known to us it is longer.

With regard to its subgenus, we think that the characters of this and the next species render the distinction of *Hendecapleura* from *Dipodillus* exceedingly doubtful, as both present, with six posterior pads, the larger bullæ characteristic of *Hendecapleura*. While doubtful about this point, however, we should like to say a word of appreciation of Lataste's remarkable, and, we believe, thoroughly sound, revision of the group, in which he evolved something like order out of chaos.

This pretty species seemed to be common, both at Lahej and Shaik Othman.

22. GERBILLUS (DIPODILLUS) LIXA, sp. n.

a. Skin. Shaik Othman. 24. II. 95.

b, *c*. Skins; *d*. In spirit. Lahej. 26–29. III. 95.

Size, proportions of trunk and tail, and general colour and appearance very much as in *Mus bactrianus*; that is to say, the pallid desert form of *Mus musculus*. Colour above greyish fawn, the slaty basis to the hairs showing through. Face-markings as in *G. pœcilops*, although much less prominent; supraorbital and postauricular white, and dark nasal spots present. Ears small, laid forwards in a spirit-specimen they just reach to the posterior canthus of the eye. Under surface and fore and hind limbs pure white throughout; hind feet very thick and lumpy; palms and soles as in *G. pœcilops*—*i. e.*, naked with five anterior and six posterior pads, the proximal plantar ones very small. Tail short, scarcely longer than the head and body, brown above, white below, its terminal inch very inconspicuously tufted.

Skull, compared with that of *G. nanus* or *G. simoni*, broader and heavier, with a much broader muzzle. Bullæ larger than in *G. simoni*, smaller than in *G. nanus*. Laminæ of molars directly transverse.

Dimensions of the type, a slightly immature female, measured in the flesh by collector:—

Head and body 65 millim.; tail 75; ear 8·5.

Skull: basal length 19·2 × 24; zygomatic breadth 13·7 × 8·4; nasals 2·4 × 4·7; interparietal 3·1 × 6·6; diastema 6·5 × 3·5; greatest diameter of bulla 8·9.

An adult male in spirit measures: head and body 70; tail 74; hind foot 21; ear 9 × 6·5.

Type. Skin *a*. B. M. No. 95.6.1.67.

This little Gerbille most nearly resembles *G. nanus*, Blanf., and its allies, but differs from any of them by its heavy lumpy feet and short and little crested tail. *G. bottæ*, Lat., of the distinction of which from *G. nanus* we are at present unable to satisfy ourselves, was founded on a specimen with a mutilated tail; but Sundevall's "*Gerbillus gerbillus*, Oliv.," likewise from Sennaar, had a tail 115 millim. long, and probably represents Lataste's species, although the latter author assigns it to his *G. quadrimaculatus*. The last-named and *G. dasyurus*, Wagn., are both long-tailed forms. One short-tailed Gerbille, *G. simoni*, Lat., has been described from Algeria; but, as is shown by a co-type in the British Museum, it differs from *G. lixa* by its much brighter coloration, its even shorter tail, and its smaller bullæ.

Specimens *b*, *c*, and *d* were caught in the cook-house of the bungalow at Lahej, and were brought to Yerbury as "mice," the habits as well as colour of which they therefore seem to imitate.

It was said to be not unusual for this animal to occur in the houses of the natives.

Specimen *a* was dug out of the sand.

23. Gerbillus ("Hendecapleura") famulus, sp. n.

a. ♀. Lahej. 10. III. 95.

Size about as in *G. campestris*. General colour, so far as can be seen in an imperfect spirit-specimen, similar to other small fawn-coloured Gerbilles, the usual whitish marks on cheeks, in front of and behind eyes, and at bases of ears apparently present; middle line of face, however, greyer, especially on the nose. Ears large, the anterior half of their outer surface thinly clothed with blackish hairs. Whole of under surface and backs of hands and feet pure white. Palms with two carpal pads as usual. Soles wholly naked, granulated distally, with four small pads only. Tail of type imperfect, but on the three inches of it present the hairs above are white with blacks tips, below wholly white.

Skull long and narrow, in size and general form not unlike, though larger than, that of *G. gerbillus*, widely separated as the two species really are. Muzzle remarkably long and slender, the nasals overhanging the incisors anteriorly to a quite unusual extent. Supraorbital edges well-rimmed, the rims thickened. Interparietal broad transversely, short antero-posteriorly. Bullæ rather large, approaching those of *G. gerbillus*, far larger than those of *G. campestris*; front wall of meatus slightly swollen. Inner cusp of middle lamina of $\underline{\text{m.}}^{1}$ slightly anterior to outer cusp.

Dimensions of the type, an adult female skin, preserved in spirit[1]:—Head and body (c.) 90 millim.; tail imperfect, 70 × . . .; hind foot 27·7; ear 16 × 10.

Skull: basal length 25·8; extreme length in middle line 31·4; greatest breadth 16; nasals 12·7 × 3·2; interorbital breadth 5·8, interparietal 3·4 × 8; palate length from henselion 13; diastema 7·9; palatal foramina 5; length of upper molar series 4·1; greatest oblique diameter of bullæ 11·2.

Type. B. M. No. 94.6.1.28.

This pretty little Gerbille is a typical member of the group to which Lataste applied the name of *Hendecapleura*, a group from which *Gerbillus* (*sens. strictiss.*) differs in its hairy feet and single carpal pad, and *Dipodillus* in its six plantar pads and smaller bullæ, although, as already noted, the latter seems to be connected with it by intermediate species.

The nearest ally of *G. famulus* is perhaps the Algerian *G.* (*H.*) *garamantis*, Lat., from which it differs by its decidedly greater size. *G. dasyurus*, *bottæ*, *quadrimaculatus*, and *nanus* are also all much smaller, while *G. persicus*, Blanf., which has the same foot-structure, is enormously larger.

The single specimen of this Gerbille was trapped at the mouth of the burrow of *Meriones rex*.

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[1] The specimen was intended for a skin, but the hairs commencing to fall it was put into spirit, never having been allowed to dry. The ear and feet measurements are therefore exact, while that of the body is merely approximate.

24. MERIONES REX, sp. n.

a–g. Seven specimens, ♂ ♀. Lahej. 6–10. III. 95.

Most closely allied to *M. shawi*, Duv. & Ler., which ranges from Algeria through Tunis and Egypt as far as the Sinaitic Peninsula. Size larger, form stouter and heavier. Fur short, poor and rather harsh, very different to the beautiful fur of *M. shawi*. General colour dirty fulvous brown above, and this colour, at least in the old specimens, extends all over the underside as well; in younger specimens, however, the underside is whitish as usual. Ears much as in *M. shawi*, but rather more thinly haired, and the whitish spot behind their outer bases less sharply defined. Hands as in *M. shawi*, the usual two large wrist-pads present. Feet very large and heavy; upper surface of metatarsals with a slight but distinct blackish suffusion; digits dull whitish; soles almost or wholly naked, the few minute hairs not hiding in any way the usual *Meriones*-structure of the skin and pads. Tail long, thick, cylindrical, uniform grizzled fawn above and below throughout, except that the hairs on the top of the terminal two inches are lengthened to form a crest, which varies in colour from black to brown.

Skull-differences are in this genus very difficult of description, owing to the great variation that takes place with age, so that it is always difficult to find specimens which may be properly compared with each other, without disturbance by the factor of age. However, among 16 skulls in the Museum collection referred with more or less certainty to *M. shawi*, there are none so large as that of the type of *M. rex*, none have such long and narrow interparietals, or have their auditory meatus so little swollen anteriorly. The bullæ are, if anything, slightly smaller in the new form than in *M. shawi*, and show therefore no approach to the huge bullæ of the *erythrurus* group.

Dimensions of the type, an old male in spirit:—

Head and body 183 millim.; tail 200; hind foot 41·5; ear 19·5.

Skull: basal length 41·2; greatest length in middle line 48; greatest breadth 27·5; nasals 19·6 × 5; interorbital breadth 8·5; tip to tip of postorbital processes 16; interparietal 5·6 × 8·7; palate, length from henselion 21·7; diastema 12·6; anterior palatine foramina 8·6; distance from hinder angle of zygoma to nearest point of wall of meatus 2·1.

Type. In spirit. B. M. No. 94.6.1.30.

This fine species, nearly or quite the largest of the genus, differs from every known *Meriones* in its practically naked soles, its dirty-coloured belly, and its darkened metatarsi. The only species for which it could be mistaken is *M. shawi*, but, besides the differences just mentioned, it is larger than that animal, and has a decidedly longer tail.

Of other Arabian species known, it may be mentioned that *M. crassus*, Sund., from Sinai, quite clearly belongs to the *erythrurus* group, with large bullæ, while *M. melanurus*, Rüpp., as shown by two co-types in the Museum collection, is simply the eastern representative of the Algerian *M. shawi*.

The large burrows found among the bushes of *Salvadora persica* on the borderland between the desert and the cultivated ground appear to be the work of this species, although several other animals also inhabit them. Thus at the mouth of one burrow there were obtained examples of *M. rex*, *Gerbillus famulus*, *Acomys dimidiatus*, and a Lizard.

M. rex appears to be on the move in the early hours of the morning until about 8 A.M., and the specimens brought home were with one exception shot at the mouths of the burrows. Owing, apparently, to these animals feeding on the green shoots of the *Salvadora*, which fermented and distended the stomachs, it was exceedingly difficult to get the specimens back to camp in fit condition for skinning, so rapidly did they spoil.

25. Arvicanthis[1] variegatus, Licht.

a–f. Skins; *g–n.* In spirit. Lahej. III. 95.

This is the common Field-Rat of the neighbourhood of Lahej, and is to be found plentifully in the ditches separating the fields—in fact anywhere where the tall rank grass grows; it does not appear to venture into the desert, nor into the rank high reeds which cover the river-bed between Haithalhim and Zaidah.

The present is, so far as we are aware, the first recorded instance of the occurrence of this genus, hitherto known as "*Isomys*," off African soil. Although with slightly larger feet and tails than in examples from Egypt, these specimens do not appear to be specifically separable from the common form.

26. Mus decumanus, Pallas.

a. Aden. II. 95.

Probably common, but no doubt introduced by sea.

27. Mus rattus typicus, L.

a. ♀. One specimen. Aden. 19. IV. 95.

No doubt also introduced from some European ship. The marked difference between this and the indigenous *M. r. alexandrinus* is noteworthy.

28. Mus rattus alexandrinus.

a–r. Aden, Shaik Othman and Lahej. 17 specimens.

Very common and generally distributed; appears to be the common Rat of the neighbourhood. All the specimens are grey above and none have the reddish coloration of *M. r. rufescens*, Gr.

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[1] Less. N. Tabl. R. A. p. 147 (1842). Type "*Lemmus niloticus*, Geoffr." (= *A. variegatus*). Syn. *Isomys*, Sund. K. Vet.-Ak. Handl. 1842, p. 219 (1843). Type "*Mus variegatus*." Thomas's attention was drawn to this unfortunate but necessary change by Mr. T. S. Palmer, of the U.S. Department of Agriculture, who has been devoting much labour to the subject of Mammal nomenclature.

29. Mus bactrianus, Blyth.

a. ♀? Lahej. 13. III. 95.

A pair were found nesting in a tree in the Sultan's garden at Lahej on the above date: the female was secured, but the male escaped. This was the only occasion on which the species was met with. The nest was in a hollow tree and was made of fine twigs and leaves of the Behr tree (*Zizyphus*, sp.).

This is the ordinary oriental representative of *Mus musculus*, of which it no doubt merely constitutes a subspecies. The typical *M. musculus* probably occurs in Aden itself, introduced from the shipping. Indeed "mice" were said to be common in the Hôtel d'Europe, although Yerbury failed to capture any of them.

30. Acomys dimidiatus, Rüpp.

a. ♂. Aden. 21. II. 95.
b. ♀. Aden. 24. II. 95.
c. Lahej. 10. III. 95.
d. ♂. Lahej. 13. III. 95.
e. Haithalhim. 25. III. 95.

The first two specimens are clearly *A. dimidiatus*, but the last three are more doubtful, and will need re-examination when further material is available.

Probably common. The Aden specimens were trapped round the house; the others at the earths of *Meriones rex*.

31. Hystrix leucura, Sykes.

a. ♂. Haithalhim. 23. III. 95.

The capture of this specimen is of much interest, as it was quite unknown what species of Porcupine occurred at Aden. The skull proves to be very similar to that of Indian examples of *H. leucura*, and wholly different to the inflated skulls of the African Porcupines *H. cristata*, *H. galeata*, and *H. africæ australis*. This resemblance to *H. leucura* confirms the reference of *H. hirsutirostris*, Wagn., which was based on a Palestine specimen, to the Indian species.

Dr. Matschie was perhaps rather venturesome in referring the Aden Porcupine to the South-African species, as he only had spines for examination, and these vary so much in different parts of the body as to be exceedingly difficult to make much of when loose and of uncertain origin.

Porcupines are very common (judging from the number of tracks) round Lahej and Haithalhim, but being nocturnal are seldom, if ever, seen. They are also very shy and cautious animals and will not, as a rule, enter a trap, therefore the way the above specimen was circumvented may be of interest. On arrival at Haithalhim tracks of Porcupines were found in every direction, and an attempt was made to shoot one by watching during the night, but without success; it was noticed, however, that the animals followed a path leading up from the bed of the Wady Kubeen to the cultivated grounds above, and an examination of the path in the morning showed a place where the path for a couple of yards or so had cut itself deep into the soft soil and formed a trench about 18 inches wide and two feet deep.

A Brailsford dog-trap was set in this trench, and a watch kept as before in the nullah. In the small hours of the morning Porcupines were to be heard about, making a sort of grunting noise, and it was decided to try and drive one of them up the path. This manœuvre was successful, and the sound of the doors falling told the hunters that the Porcupine had been more afraid of them than of the strange metal case in front, and in attempting to rush through had got caught.

32. Lepus arabicus, Hempr. & Ehr.

a, b. Heads. Lahej. 7. III. 95.
c. ♂. Lahej. 17. III. 95.

These three specimens are probably conspecific, but whether or not two species exist at Aden is a moot point. Yerbury is inclined to believe that there are two Hares in the district, differing considerably in size. The smaller one may perhaps be Thomas's *L. omanensis*, described from Muscat.

33. Gazella bennetti, Sykes?

a. Frontlet ♂, without date, &c.

We are somewhat doubtful about our reference of this Gazelle to *G. bennetti*, but not only does this frontlet correspond very closely with Indian examples, but a specimen from Aden, now alive at the Zoological Gardens, has been referred by Mr. Sclater to the same species.

Gazelles are common inland round Aden, and possibly two or more species are to be met with in the neighbourhood.

34. Capra sinaitica, Hempr. & Ehr.

An Ibex appears to be not uncommon in the mountains inland, though the British officers who have been there after them on shikar expeditions do not appear to have been very successful. Horns are occasionally to be bought in Aden.

35. Halicore dugong, Ill.

Dugong are to be found at Little Aden. One was on view during March 1895 at Steamer Point, and another was thrown up on the beach in front of the European Infantry lines about the same time and caused the municipal authorities some trouble before the carcase was disposed of.

36. Balænoptera, sp.

The skull of a large Finner, perhaps *B. edeni*, is to be seen near the Eed Ghur, Camp Aden. The animal was said to have been cast ashore some 30 miles to the north-east, and the skull was brought to Aden because it was supposed that it might be useful for making knife-handles, &c.

4. A Monograph of the Bornean *Lycænidæ*.

By Hamilton H. Druce, F.Z.S., F.E.S.

[Received June 14, 1895.]

(Plates XXXI.–XXXIV.)

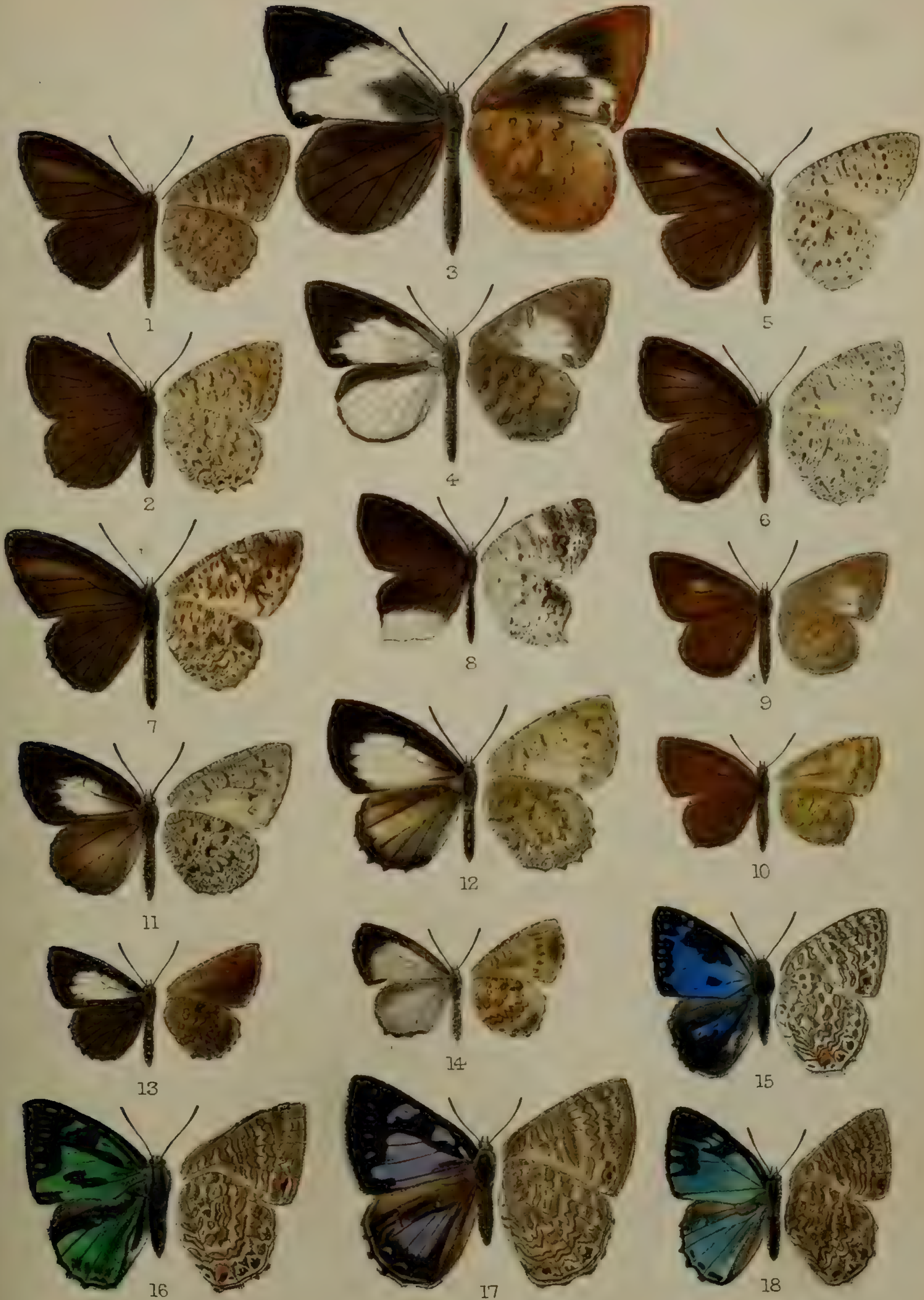
Since my father, Mr. Herbert Druce, published, in the Proceedings of this Society for 1873, a list of Bornean butterflies obtained by Mr. (now Sir Hugh) Low in the neighbourhood of Labuan, very little has been written on the subject at all and scarcely any additions have been made to our knowledge of the *Lycænidæ*. Messrs. Distant and Pryer have described a few, obtained at Sandakan by Mr. Pryer, in the 'Annals and Magazine of Natural History' (ser. 5) vol. xix. 1887, as also has Mr. Grose Smith in vol. iii. (ser. 6), 1889, of the same periodical; whilst Mr. de Nicéville has mentioned some species as occurring in Borneo in his work on the Butterflies of India, Burmah, and Ceylon, and has described one or two in the Journal of the Bombay Natural History Society, 1891. In the Journal of the Asiatic Society of Bengal, vol. lx. 1891, Mr. W. Doherty has recorded a few species, and described a new one of the genus *Nacaduba*, and Dr. Butler, in an account of a collection of Lepidoptera obtained by Mr. W. B. Pryer at Sandakan published in the Proceedings of this Society (P. Z. S. 1892, p. 121), has described a single species of the genus *Arhopala*. These papers, with the addition of one or two solitary descriptions, are all that I can discover as referring to the *Lycænidæ* of the region dealt with here.

The large amount of material which I have worked upon for this paper is partly contained in Messrs. Godman and Salvin's collection, and my thanks are due to those gentlemen for kindly allowing me free use of their fine series, and also to Dr. Staudinger, to whom I am also much indebted for the opportunity of examining the whole of the specimens collected on Kina Balu by Waterstradt and at Labuan by Wahnes. This collection from Kina Balu, containing as it does examples of a large number of new species, I have found of the greatest importance; and to those interested in the geographical and other features of this great mountain I would recommend a perusal of Mr. J. Whitehead's book, 'The Exploration of Kina Balu, N. Borneo.' Besides these collections, we have in our own possession a considerable number of specimens from Kina Balu, Elopura, Sarawak, and Sandakan.

Dr. Staudinger informs me that the species labelled "Labuan," captured by Waterstradt and Wahnes, are not from the small island on the N.W. coast but from the mainland opposite.

Mr. Herbert Druce recorded 71 species of the family in his list, and this number I am now able to increase to about 220, inclusive of about a dozen species of the genus *Arhopala* which are either undetermined or unnamed. Mr. de Nicéville enumerates 402 species in 'The Butterflies of India etc.,' so that we have already

P.Z.S.1895. Plate XXXI



W.Purkiss lith.

West, Newman imp.

Bornean Lycænidæ.

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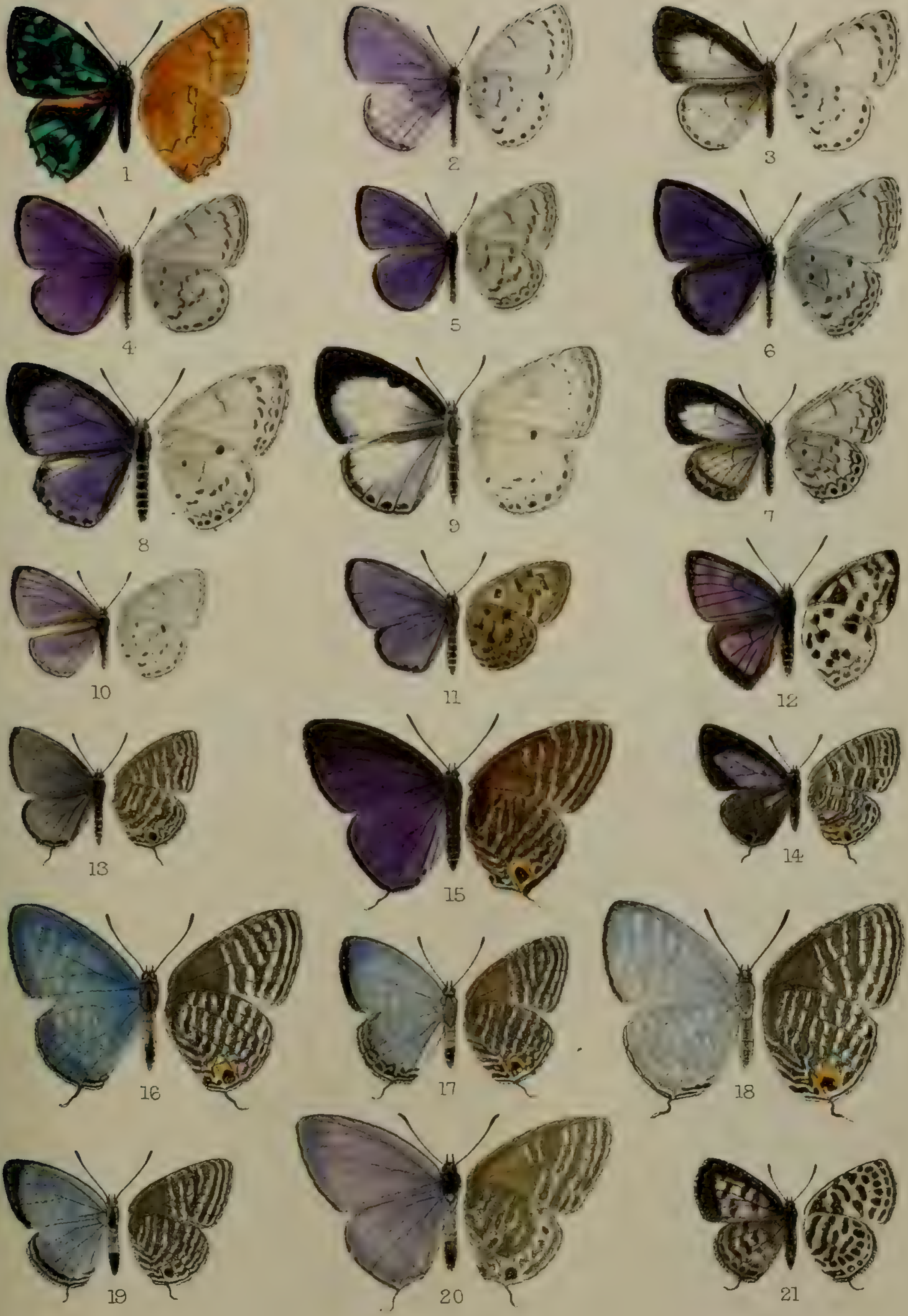

W.Purkiss lith.
West, Newman imp.

Bornean Lycænidæ.

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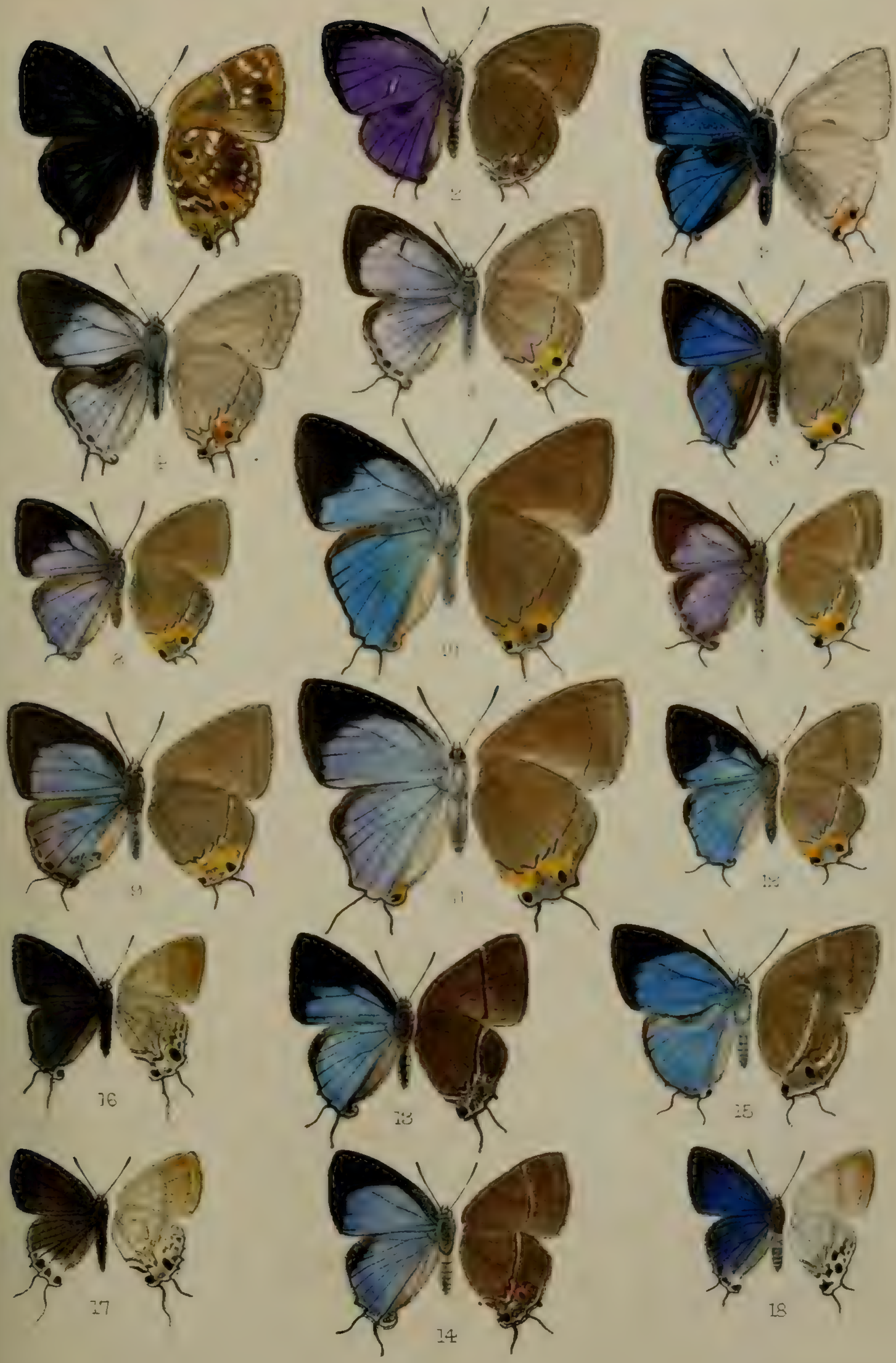

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Bornean Lycænidæ.

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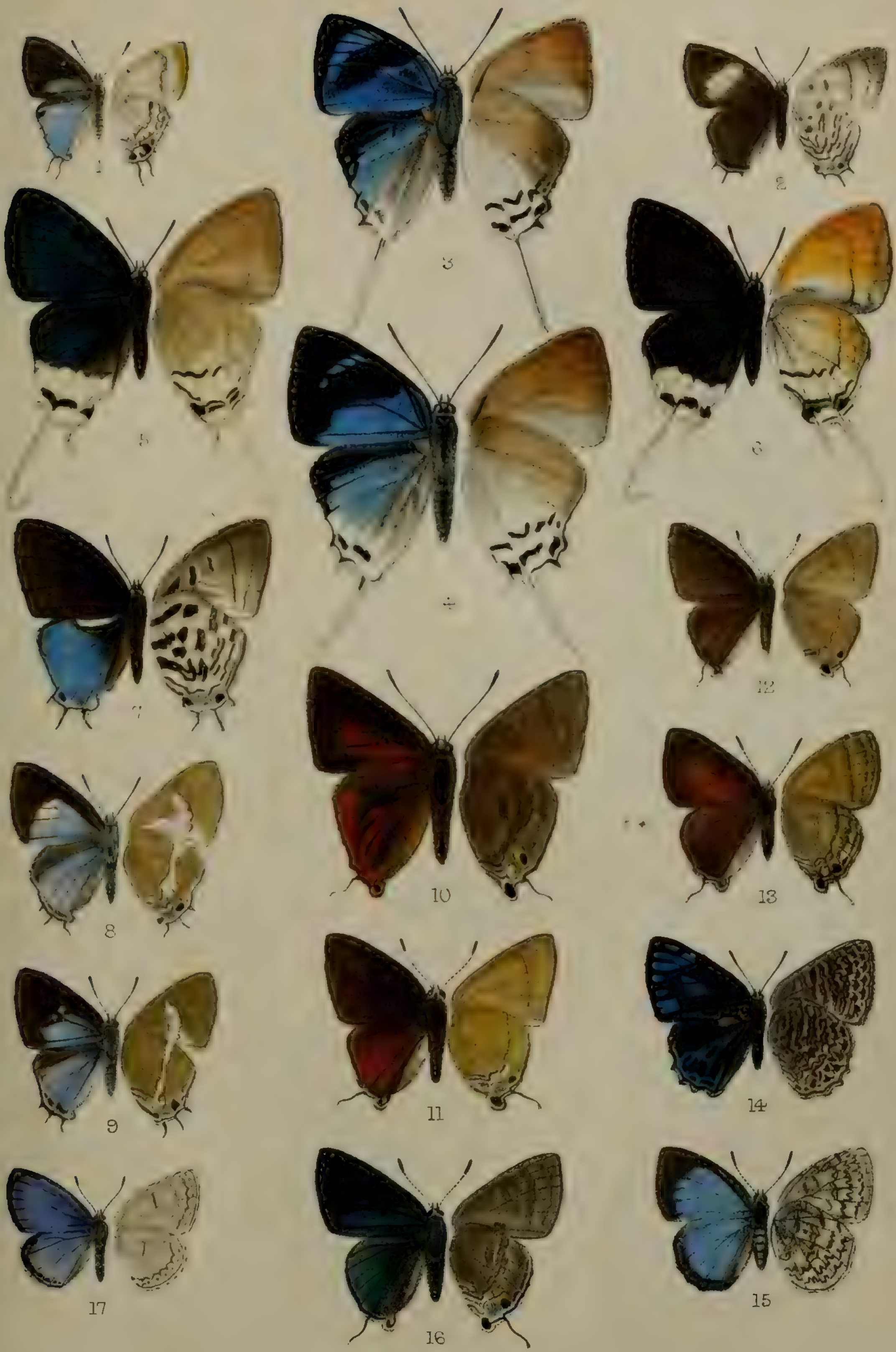
T.E.S. 1895. Plate XXXIV.



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Bornean Lycænidæ.

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from Borneo, in which island but two or three localities have been anything like worked, more than half as many species as have been found in the extensive region of which his book treats. In 'Rhopalocera Malayana' Mr. Distant has recorded 133 species of the family, so that with these facts one may conclude that the *Lycænidæ* are very well represented in Borneo. Mr. H. J. Elwes has expressed his opinion that when the higher mountain-ranges of Java, Sumatra, Borneo, &c. come to be explored there will be found to be a considerable resemblance between the butterflies inhabiting them and those of the Himalayas; and so far as the *Lycænidæ* are concerned I think a perusal of the following pages will confirm this.

Besides the number of types of Bornean species which are contained in Messrs. Godman and Salvin's collection, Dr. Staudinger has kindly sent me the whole of his types of Palawan species described in 'Iris,' vol. ii., which I have found very useful and in some cases absolutely necessary for correct identification.

The arrangement here followed is that of Mr. de Nicéville's admirable work, 'The Butterflies of India, Burmah, and Ceylon.'

The following is a list of the species noted in this paper—those marked with an * being new species described from adjacent localities:—

Gerydus gigas, sp. n., p. 559.
„ symethus, *Cr.*, p. 559.
„ petronius, *Distant & Pryer*, p. 559.
„ innocens, sp. n., p. 560.
„ biggsii, *Distant*, p. 560.
„ philippus, *Staud.*, p. 561.
„ vincula, sp. n., p. 561.
Paragerydus horsfieldi, *Moore*, p. 561.
„ waterstradti, sp. n., p. 562.
„ pyxus, *de Nicév.*, p. 562.
„ moorei, sp. n., p. 562.
„ taras, *Doherty*, p. 563.
„ caudatus, *Grose Smith*, p. 563.
„ fabius, *Dist. & Pryer*, p. 563.
„ aphocha, *Kheil*, p. 563.
Allotinus subviolaceus, *Feld.*, p. 563.
„ audax, sp. n., p. 564.
„ nivalis, *Druce*, p. 564.
„ unicolor, *Feld.*, p. 564.
Logania regina, *Druce*, p. 564.
„ obscura, *Dist. & Pryer*, p. 565.
„ staudingeri, sp. n., p. 565.
Cyaniriodes libna, *Hew.*, p. 565.
Poritia sumatræ, *Feld.*, p. 566.
„ phormedon, sp. n., p. 566.
„ pellonia, *Dist. & Pryer*, p. 566.
„ phaluke, sp. n., p. 567.
„ philota, *Hew.*, p. 567.
„ *phare, sp. n., p. 567.
„ plateni, *Staud.*, p. 567.
Poritia phama, sp. n., p. 568.
„ phalena, *Hew.* ♂, p. 568.
„ *solyma*, de Nicév. ♀, p. 568.
„ pheretia, *Hew.*, p. 569.
„ phalia, *Hew.*, p. 569.
„ philura, sp. n., p. 569.
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*Poriskina phakos, sp. n., p. 570.
Pithecops hylax, *Fab.*, p. 570.
Neopithecops zalmora, *Butler*, p. 570.
Spalgis epius, *Westw.*, p. 570.
„ nubilus, *Moore*, p. 571.
Taraka hamada, *Druce*, p. 571.
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„ puspa, *Horsf.*, p. 572.
„ placidula, sp. n., p. 572.
„ lugra, sp. n., p. 573.
„ *phuste, sp. n., p. 573.
„ selma, sp. n., p. 573.
„ strophis, sp. n., p. 573.
„ plauta, sp. n., p. 574.
„ ripte, sp. n., p. 574.
Lycænopsis haraldus, *Fab.*, p. 575.
Zizera otis, *Fab.*, p. 575.
Lycænesthes emolus, *Godt.*, p. 575.
„ lycænina, *Feld.*, p. 575.
Niphanda reter, sp. n., p. 576.
Luthrodes (nov.) mindora, *Feld.*, p. 576.
Everes argiades, *Pallas*, 577.
Nacaduba pavana, *Horsf.*, p. 577.
„ lugine, sp. n., p. 577.
„ angusta, *Druce*, p. 577.
„ atratus, *Horsf.*, 578.

Nacaduba beroë, *Feld.*, p. 578.
,, bhutea, *de Nicév.*, p. 578.
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,, aratus, *Cr.*, p. 584.
,, adana, *Druce*, p. 584.
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,, plinius, *Fab.*, p. 586.
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,, ethion, *Doub.*, *Hew.*, p. 586.
,, elna, *Hew.*, p. 586.
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,, agnis, *Feld.*, p. 589.
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,, donatana, *de Nicév.*, p. 602.
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Suasa liris, *Staud.*, p. 603.
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,, thecloides, *Feld.*, p. 603.
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,, phemis, sp. n., p. 604.
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„ „ var. albula, nov., p. 617.
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„ etias, *Dist. & Pryer*, p. 618.
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„ maneia, *Hew.*, p. 619.
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„ nedymond, *Cr.*, p. 620.
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„ sphinx, *Fab.*, p. 621.
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„ scintilla, *de Nicév.*, p. 622.
„ varuna, *Horsf.*, p. 622.
„ *orseis*, Hew., p. 622.
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„ pheretima, *Hew.*, p. 623.
„ xenophon, *Fab.*, p. 623.
„ barthema, *Dist.*, p. 623.
„ laima, sp. n., p. 624.
„ drasmos, sp. n., p. 624.
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„ amata, *Dist.*, p. 625.
Liphyra brassolis, *Westw.*, p. 626.

GERYDUS, Boisd.

GERYDUS GIGAS, sp. n. (Plate XXXI. fig. 3 ♂.)

Miletus gigas, Staud. MS.

♂ ♀. Allied to *G. gigantes*, de Nicév., in size and form, but differing from that species by the basal area of the fore wing being greyish black, extending to the median nervules, and in the female reaching nearly across the white area to the apical black margin, and by the hind wings being uniform greyish black. The underside differs from *G. gigantes* by the male only possessing rather larger white patches on the fore wing.

Kina Balu (*Waterstr.*). Type Mus. Staud., Mus. Druce.

This fine species can be at once distinguished from *G. gigantes* from N.E. Sumatra by the black basal area of the fore wing and by the black hind wings. The male of *G. gigantes* has "a small portion of the base of the third median nervule prominently swollen;" in *G. gigas* this swollen portion is nearly $\frac{1}{5}$ inch long.

This is allied to *G. ancon*, Doherty, but the description, however, does not quite fit it, notably as regards the "marginal dark line" on the underside, which is absent in *G. gigas*. The figure given by Mr. Doherty of the male is much like *gigas* ♀.

GERYDUS SYMETHUS.

Papilio symethus, Cr. Pap. Ex. ii. pl. cxlix. figs. B, C (1777).

Labuan (*Wahnes* and *Low*); Sandakan (*Pryer*).

The female from Sandakan has the white on the hind wing reduced to a discal streak and is very pale on the underside, but the markings appear to be the same as in the typical form.

GERYDUS PETRONIUS.

Gerydus petronius, Distant & Pryer, Ann. Mag. Nat. Hist ser. 5, xix. p. 266 (1887).

Elopura.

I have not seen this species, the female only of which is described. We possess specimens from Nias I. which are referred to *G. symethus*, but which possibly are *G. petronius* if this should prove to be a distinct species.

GERYDUS INNOCENS, sp. n. (Plate XXXI. fig. 4 ♂.)

Miletus innocens, Staud. MS.

♂. Upperside: fore wing white, the apical half and outer margin to anal angle black, greyish along the costa to about the middle of the cell: hind wing white, slightly tinged with greyish; costal margin broadly black; anal and outer margins narrowly dusted with blackish brown, darkest at the tips of the nervules. Underside: ground-colour pale grey, with dark chocolate markings and spots arranged much as in *G. symethus*, but the short band near the apex of the fore wing straighter and broader and the basal streak below the cell ending abruptly where it meets the white, just beyond the base of the lower median nervule, not running along the nervules as in *G. symethus.*

♀. Upperside differs only from male by the white area of the fore wing being slightly more extensive, by the purer white of the hind wing, which has the outer margin dentated rather more strongly than *G. symethus* ♂, the cilia only being fuscous. Underside as male, but with the white discal area slightly larger.

Expanse, ♂ $1\frac{4}{5}$, ♀ $1\frac{1}{2}$ inch.

Kina Balu (*Waterstr.*). Types Mus. Staud.

G. innocens is much like *G. gigantes* on the upperside, but is very different below, and the dentated outer margin of the hind wing of the female also distinguishes it. The swollen base to the third median of the fore wing in the male, which is present, so far as I know, in all other species of the genus, is entirely wanting, in *G. innocens.* The coloration of the underside is quite different from *G. symethus.* Dr. Staudinger has sent me a pair of this interesting butterfly.

GERYDUS BIGGSII.

Gerydus biggsii, Distant, Rhop. Malay. p. 206, pl. xxii. fig. 12, ♀ (1884).

Gerydus gopara, de Nicév. Butt. India etc. iii. p. 25 (1890).

Kina Balu (*Waterstr.*); Sandakan (*Pryer*); Labuan (*Low* and *Wahnes*).

This is a somewhat puzzling species, as it appears to vary considerably in the width of the white band on the fore wing: in males from Sandakan and Kina Balu it is shortest and narrowest, and in one specimen in Messrs. Godman and Salvin's collection is practically reduced to a median patch, being almost all below the third median nervule; in a male from Labuan in Dr. Staudinger's collection it is broad and long and the basal area is much paler than usual. The females before me from Kina Balu are much like the male noted above from Labuan and present a very different appearance from Mr. Distant's figure.

GERYDUS PHILIPPUS.

Miletus philippus, Staud. Lep. Palaw. p. 92, pl. i. fig. 2 (1889).
Gerydus irroratus[1], Semper (nec Druce), Schmett. Phil. Insel. p. 162, pl. xxxi. figs. 10, 11, 12 (1889).
Labuan (*Low* and *Wahnes*).

Both sexes of this species from Borneo agree exactly with Herr Semper's figures. Dr. Staudinger has kindly sent me his types for examination, and I quite agree with Herr Semper (*vide* Supp. Schmett. Phil. Insel.) that they are conspecific; but as *irroratus*, Druce, falls before *boisduvali*, Moore, Dr. Staudinger's name must stand.

Dr. Staudinger possesses a female from S.E. Borneo, near Banjarmasin, taken by Wahnes, which may possibly represent another species, as the band on the upperside is very narrow and obscured and the underside is of a reddish-brown hue; but without seeing a male I do not care to describe it.

The specimen referred to *M. zinkenii*, Feld., by Mr. Herbert Druce (P. Z. S. 1873, p. 348), is an example of *G. philippus*.

GERYDUS VINCULA, sp. n. (Plate XXXI. figs. 9 ♂, 10 ♀.).

♂. Upperside uniform dull brown, with a pale oval spot at the base of the third median nervule of the fore wing, which just surrounds the swollen portion of the vein. Underside much like that of *G. philippus* but paler, and with a submarginal band of confluent markings extending from the apex to the outer angle of the fore wing and with the marginal spots very indistinct.

♀. Form of *G. philippus*: upperside uniform dull brown without markings; underside as male.

Expanse, ♂ $1\frac{3}{10}$, ♀ $1\frac{1}{10}$ inch.

Borneo.

This obscure species is, I believe, the only one of the genus which has the ultra-median band on the underside of the fore wing extending across the wing to the anal angle—it usually ends somewhere about the third median nervule; the sombre colouring of the female is also unusual. The types are in Messrs. Godman and Salvin's collection, the male received from Dr. Staudinger and the female formerly in Bates's cabinet, neither being exactly localized[2].

PARAGERYDUS, Distant.

PARAGERYDUS HORSFIELDI.

Miletus horsfieldi, Moore, Horsf. & Moore, Cat. Lep. Mus.

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[1] I have carefully examined the type of Mr. Herbert Druce's *Miletus irroratus*, which is in Messrs. Godman and Salvin's collection, and find that it is quite impossible to separate it from *G. boisduvali*, Moore.

[2] I have not included the *Megalopalpus simplex*, described by Herr Röber ('Iris,' i. p. 51, pl. iv. f. 1. 1885) from Borneo, as I am of opinion that it is an African species closely allied to, or identical with, the *Pentila zymna*, Doub., Hew. I have not seen *M. simplex*, and judge from the figure only, which is from a photograph.

E. I. C. vol. i. p. 19, pl. 1 *a*. fig. 2 (1857); Druce, P. Z. S. 1873, p. 347.

Kina Balu (*Waterstr.*); Labuan (*Waterstr.* and *Low*); Elopura (*Pryer*); S.E. Borneo (*Wahnes*).

Mr. Pryer took the species in March.

Paragerydus waterstradti, sp. n. (Plate XXXI. figs. 1 ♂, 2 ♀.)

♂. Upperside allied to *P. horsfieldi*, Moore; same shade of brown, but with the discal patch more elongated and less distinct. Underside pale brown, with darker markings and spots and a marginal row of black spots inwardly bordering white dots.

♀. Upperside uniform dull brown, not paler discally in the fore wing; underside as male, but ground-colour rather paler.

Ab. absens, nov.

♀. Upperside as typical female; underside pale brownish cream-colour, with the larger brown markings only present, the wavy lines being entirely wanting.

Expanse, ♂ $1\frac{7}{10}$–$1\frac{1}{2}$, ♀ $1\frac{3}{5}$–$1\frac{1}{2}$ inch.

Kina Balu (*Waterstr.*). Mus. Staud. and Druce.

P. waterstradti differs from *P. horsfieldi* by the more elongate discal band and by the underside being usually darker. It is also a smaller insect, noticeable especially in the males. The variety described above presents a very curious appearance.

Paragerydus pyxus.

Paragerydus pyxus, de Nicév. J. A. S. B. vol. xliii. pt. 2, no. 1, p. 27, pl. v. fig. 2, ♂ (1894).

Borneo.

Described as rufous brown on the upperside.

Paragerydus moorei, sp. n. (Plate XXXI. figs. 5 ♂, 6 ♀.)

Miletus moorei, Staud. MS.

♂. Upperside dull brown, colour of *P. waterstradti*, but with the discal patch paler, more conspicuous, and about half as long as in that species. Underside pure white, with spots and striæ much as in that species and *P. horsfieldi*, but with the marginal row of spots placed further from the margin in both wings.

♀. Upperside uniform dull brown, with disc of fore wing slightly paler. Underside as in male.

Expanse, ♂ $1\frac{7}{10}$, ♀ $1\frac{1}{2}$ inch. Mus. Staud.

Kina Balu (*Waterstr.*).

This species should be distinguished from its allies by the pure white ground of its underside and by the short discal spot on the male above.

The male appears to agree exactly with Mr. de Nicéville's figure of *P. horsfieldi* (Butt. Ind. iii. pl. xxvi. fig. 156), which I believe is not the true *P. horsfieldi*, Moore, as the discal band is considerably shorter. *P. horsfieldi* occurs in Java, Sumatra, Borneo, and Malacca.

PARAGERYDUS TARAS.

Paragerydus taras, Doherty, J. A. S. B. vol. lviii. pt. 2, p. 437, t. xxiii. fig. 10 (1889).

S.E. Borneo (north of Banjarmasin) (*Wahnes*).

I have received a specimen which agrees well with Mr. Doherty's description and figure, excepting that it has a faint indication of a pale spot on the disc of the fore wing above.

PARAGERYDUS CAUDATUS. (Plate XXXI. figs. 7 ♂, 8 ♀.)

Allotinus caudatus, Grose Smith, Ann. Mag. Nat. Hist. ser. 5, vol. xii. p. 34 (1893).

♂. Upperside dull brown; the discal streak on the fore wing elongated and inconspicuous, much like *P. waterstradti*, which it closely resembles on the upperside in coloration and shape of both wings. Underside as female, but ground-colour tinged with brown and rather more heavily marked.

Expanse, ♂ $1\frac{7}{10}$, ♀ $1\frac{2}{5}$ inch.

Kina Balu (*Waterstr.*).

I have compared the female with Mr. Grose Smith's type and find them identical; it is remarkable for the shape of the hind wing, the third median nervule being produced so as to form a blunt tail, and in this respect differs from all others in the genus. In neuration it appears to be a typical *Paragerydus*.

PARAGERYDUS FABIUS.

Paragerydus fabius, Distant & Pryer, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 266, ♀ (1887).

Sandakan (*Pryer*).

This species is known to me only by the description; quite possibly it is the same as the preceding (*P. caudatus*), but Mr. Distant does not describe a projecting third median nervule in the hind wing, which is such a distinctive character in that species.

PARAGERYDUS APHOCHA.

Allotinus aphocha, Kheil, Rhop. Ins. Nias, p. 28, pl. v. fig. 30 (1884).

Labuan (*Wahnes*).

One specimen, a male, which is identical with several males from Nias Islands.

The outer margin of the hind wing is always strongly dentate. It appears to differ from *P. horsfieldi* by its much smaller size and by the pale ground-colour below, and by the comparatively small discal spot above.

ALLOTINUS, Feld.

ALLOTINUS SUBVIOLACEUS.

Allotinus subviolaceus, Feld. Reise Nov., Lep. ii. p. 286, t. 35. figs. 27, 28 (1865).

Kina Balu (*Waterstr.*).

The male agrees well with Felder's figure. The differences which separate *A. alkamah*, Distant, from this species, appear to be exceedingly slight; indeed males before me from Malacca and Kina Balu are identical, whilst one Bornean female has nearly the whole of the hind wing dusted with bluish scales. Mr. de Nicéville records *A. alkamah* from Borneo (Butt. Ind. iii. p. 30).

ALLOTINUS AUDAX, sp. n. (Plate XXXI. figs. 11 ♂, 12 ♀.)

Miletus audax, Staud. MS.

♂. Upperside allied to *A. subviolaceus*, Feld., but with the blue discal band replaced by a narrower creamy-white band; hind wing blackish brown, slightly paler on the disc. Underside much as in *A. subviolaceus*, but the ground paler and the spots and striæ standing out more distinctly.

♀. Upperside as *A. subviolaceus* ♀, but the blue areas replaced by clear creamy white; underside as male, but spots and striæ rather paler.

Kina Balu (*Waterstr.*). Mus. Staud. and Druce.

ALLOTINUS NIVALIS.

Miletus nivalis, Druce, P. Z. S. 1873, p. 348.

Sandakan (*Pryer*); Kina Balu (*Waterstr.*); Labuan (*Low*); S.E Borneo (*Doherty*).

The *L.* (=*A.*) *substrigosa*, Moore, may be a distinct species, as the type and all other specimens I have examined from Borneo have the black spot on the costa of the hind wing below replaced by a pale brown one; this, however, is the only difference I can detect between these specimens and three in our collection from the Tenasserim Valley (*Doherty*), in all of which the black spot is very distinct.

ALLOTINUS UNICOLOR.

Allotinus unicolor, Feld. Reise Nov., Lep. ii. p. 286 (1865); Distant & Pryer, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 266 (1887).

Sandakan (*Pryer*).

A. unicolor is included here on the authority of Messrs. Distant and Pryer. I do not know the species.

LOGANIA, Distant.

LOGANIA REGINA.

Miletus regina, Druce, P. Z. S. 1873, p. 348, pl. xxxii. fig. 4.

Labuan (*Low*); Sandakan (*Pryer*).

This species, which together with *L. lahomius*, Kheil, is a true *Logania*, is closely allied to *L. sriwa*, Distant, from which it principally differs by the inner marginal area of the fore wing below being white; in *L. sriwa* it is blackish brown. The type, a male, is now in Messrs. Godman and Salvin's collection.

LOGANIA OBSCURA.

Logania obscura, Distant & Pryer, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 266 (1887).

Sandakan (*Pryer*).

It is, I fear, impossible to make out the species from the description given.

LOGANIA STAUDINGERI, sp. n. (Plate XXXI. figs. 13 ♂, 14 ♀.)

♂. Upperside: fore wing pale greyish blue, costal margin rather broadly, apex and outer margin broadly black; hind wing black. Underside: fore wing blackish grey, the costal margin and apex, as also a narrow outer-marginal line, rufous brown; a broad brown fascia crossing the cell just beyond its middle, and another much the same at the end of the cell: hind wing rufous brown, with two sinuous median bands crossing the wing from about the centre of the costal margin to the anal margin; these bands are rather darker brown than the ground-colour, and edged on both sides with black lines; the centre of the costal margin, as also the outer margin from its middle towards the anal angle, clouded with black.

♀. Upperside pale greyish white, apex broadly brown, narrowing towards angle: hind wing greyish; costal margin rather broadly, outer margin very narrowly fuscous. General appearance much like *L. sriwa*, Dist., ♂. Underside as male but paler.

Expanse, ♂ ♀, 1⅕ inch.

Kina Balu (*Waterstr.*). Mus. Staud.

The disc of the fore wing in the male is nearly as blue as in *A. subviolaceus*, Feld.

CYANIRIODES, de Nicév.

v. de Nicév. Butt. Ind. etc. iii. p. 33 (1890).

CYANIRIODES LIBNA, Hew.

Hypolycæna libna, Hew. Ill. Diurn. Lep., *Lyc.* Supp. p. 15, pl. v. (Supp.) figs. 39, 40, ♀ (1869).

♂. Upperside dark shining emerald-green: fore wing—costal margin rather narrowly, outer margin broadly, black; a black quadrate spot at the end of the cell confluent with the black costal margin: hind wing—apex narrowly, outer margin and anal fold broadly, black; costal margin greyish; an oval shining patch below and adjoining the subcostal nervure just before the middle, on which lies a short tuft of black hairs, which appears to be attached to the membrane of the wing close to the subcostal nervure; there is also a small tuft of black hairs placed close to the base, which are directed upwards, and are partially covered by the fore wing. Underside as ♀. There are no tails.

Sandakan, Borneo (*Hew.*).

Mr. H. J. Elwes has kindly sent me for examination a male of this interesting and rare species, which I have described above. I find it impossible to make out the neuration correctly without clearing the wing of scales; but the possession of the tufts of hair seems to show that it is closely allied to *Poritia*, next to which I have placed it.

The type in the Hewitson collection, which is in poor condition and has lost its abdomen, is the only female I have seen. On the underside the markings are somewhat like those of *Poritia*, but the wings are less thickly covered.

PORITIA, Moore.

When Mr. Herbert Druce wrote his list of Bornean butterflies, one species only of this beautiful group was known from the country, but shortly after Hewitson described two (1874). I am able to include four new species, which, together with representatives of species described principally from other localities, brings the number up to about ten.

PORITIA SUMATRÆ.

Pseudodipsas sumatræ, Feld. Reise Nov., Lep. vol. ii. p. 259, pl. xxxvi. figs. 24–26 (1865); Druce, P. Z. S. 1873, p. 351.

Labuan (*Low*).

A single male in Messrs. Godman and Salvin's collection is my only authority for including this well-known species.

PORITIA PHORMEDON, sp. n. (Plate XXXI. figs. 16 ♂, 17 ♀.)

♂. Upperside brilliant emerald-green, closely allied to *P. hewitsoni*, Moore, from which it differs by the fore wing possessing a broad, arched, green streak along the upper wall of the cell, extending from the base nearly to the end, sharply defined at its extremity; the black spot in the submedian interspace is large and prominent. Underside greyer, with the bands broader and more regular, and with their edges less distinctly prominent.

♀. Upperside: fore wing entirely without the ochreous which is usually present in that sex of *P. hewitsoni*, and without the brown streak which is usual in the submedian interspace of that species; the blue streak in the cell as described in the male is very prominent, and is entirely absent in *P. hewitsoni*: hind wing with a small ochreous streak in the cell at its outer extremity. Underside as male, but paler.

Expanse, ♂ ♀, $1\frac{7}{10}$ inch.

Kina Balu (*Waterstr.*). Mus. Staudinger.

P. phormedon is the Bornean representative of *P. hewitsoni*, and presents sufficient differences to be considered distinct. It is also a much larger insect. Dr. Staudinger writes me that he has only received a pair.

PORITIA PELLONIA.

Poritia pellonia, Distant & Pryer, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 265 (1887).

Sandakan.

I have not seen this species; on the underside it is said to be similar to *P. pleurata*, Hew., from Singapore.

PORITIA PHALUKE, sp. n. (Plate XXXI. fig. 15 ♂.)

♂. Upperside: fore wing rich ultramarine-blue, with a large oblong black patch about the middle of the costa, which is also black, extending downwards to the median nervure; apex and outer margin black, irregularly serrated on its inner edge: hind wing black, with a rather broad central ultramarine-blue streak extending from the base nearly to the outer margin, sharply bordered on its upper edge by the median nervure. Underside much like that of *P. phraatica*, Hew., but the ground-colour much whiter and the markings somewhat narrower, and the bands more broken and with their edges darker and more conspicuous.

♀. Upperside brown, with dark margins much as in *P. phraatica*. Underside as male, but paler.

Expanse 1⅗ inch.

Kina Balu (*Waterstr.*). Mus. Staudinger.

The female appears to be identical with the type of Hewitson's *P. phraatica*; but the male is very different from the male of that species which I have before me from Malacca (*Eichorn*), and which has been described by Mr. Distant. By the single streak on the hind wing it seems to be allied to *P. pellonia*, Dist. & Pryer.

PORITIA PHILOTA.

Poritia philota, Hew. Trans. Ent. Soc. 1874, p. 346; Ill. Diurn. Lep., *Lyc.* p. 217, pl. 89. fig. 20 (1878).

Labuan (*Wahnes*); N.E. Borneo (*Mus. G. & S.*).

I have received specimens which are identical with Hewitson's type from Sumatra; we also possess a male from Java. Messrs. Godman and Salvin's collection also contains a pair from Borneo, and a single male from the Philippine Islands (*Pryer*)[1]. The female is dull brown, slightly ochreous on the disc of the fore wing, and towards the outer margin of the hind wing; on the underside it is much paler than the male.

PORITIA PLATENI.

Poritia plateni, Staud. Iris, ii. p. 104, pl. i. fig. 8 (1889).

Kina Balu (*Waterstr.*).

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[1] Dr. Staudinger has sent another form which I believe is distinct and describe as below:—

PORITIA PHARE, sp. n. (Plate XXXIV. fig. 14 ♂.)

♂. Upperside allied to *P. philota*, but larger, and with the blue streak in the cell replaced by a small blue spot about its middle, close to the subcostal nervure. Underside: ground-colour pale grey, with the bands and spots much as in *P. philota* and standing out prominently.

Expanse 1⅗ inch.

Hab. Mindanao, Davao (*Platen*). Type Mus. Staud.

This species should be at once distinguished from *P. philota* by the pale ground of the underside, thus throwing up the markings prominently.

Through the kindness of Dr. Staudinger I have been able to examine two specimens from Borneo, and the type of the species which was obtained from the island of Palawan. I find that the irregular dark blotches vary slightly in intensity and shape; indeed, in neither one of the specimens are they alike in the corresponding wings. The species should be easily recognized, as it is quite unlike any other in the genus. It is a true *Poritia*, as defined by Mr. de Nicéville.

PORITIA PHAMA, sp. n. (Plate XXXI. fig. 18 ♂.)

♂. Fore wing, upperside brilliant greenish blue, apex and outer margin down to lower median nervule broadly black, then narrowly black; a quadrate black spot at the end of the cell adjoining the black costa and evenly bordered by the end of the cell, the third median nervule, and towards the apex by a short band of blue which is intersected by black nervules. Hind wing greenish blue, costal third and anal fold greyish; a marginal row of small black spots between the nervules, most distinct towards the anal angle. Underside much like *P. phormedon*, but with the markings of a more reddish hue.

Expanse $1\frac{3}{10}$ inch.

Kina Balu (*Waterstr.*).

I have a specimen before me belonging to Dr. Staudinger labelled "Vulcan Gede, West Java," which I take to be this species; it agrees exactly with Bornean specimens on the upperside, but on the underside the bands are straighter and somewhat more compressed together, thus leaving broader ground-spaces, and are rather more reddish, but these are peculiarities which I have noticed in *P. hewitsoni*, Moore.

PORITIA PHALENA.

Poritia phalena, Hew. Trans. Ent. Soc. 1874, p. 344; Ill. Diurn. Lep., *Lyc.* p. 216, pl. lxxxix. figs. 14, 15 (1878).

♀. *Simiskina solyma*, de Nicév. J. A. S. B. vol. lxiii. pt. ii. no. 1, p. 29, pl. iv. fig. 10 (1894).

Labuan (*Waterstr.*). ♂ ♀.

The male received from Labuan agrees exactly with Hewitson's type in the British Museum, and the female with Mr. de Nicéville's description and figure of *S. solyma*, excepting that the discal spot is not quite so clearly white in any light. So far as I can tell the neuration agrees with that of *Poritia*, but the tuft of long black hairs attached to the base of the submedian nervure in the hind wing is wanting, and I notice that Mr. Doherty in describing a near ally, viz. *P. hartertii*, from Upper Assam, does not mention this patch. Why Mr. de Nicéville should place his insect (a female) in the genus *Simiskina* I do not know.

The sexes are remarkable for the disparity in size, the male before me measuring $1\frac{1}{5}$ inch, the female $1\frac{7}{10}$ inch.

The species has not been recorded since Hewitson obtained the type.

PORITIA PHERETIA.

Poritia pheretia, Hew. Trans. Ent. Soc. 1874, p. 346; Ill. Diurn. Lep., *Lyc.* p. 217, pl. lxxxix. figs. 16, 17, 18 (1878).

Sandakan.

Mr. H. J. Elwes has sent me for examination a single female specimen which is referable to this species.

PORITIA PHALIA.

Poritia phalia, Hew. Trans. Ent. Soc. 1874, p. 345; Ill. Diurn. Lep., *Lyc.* p. 216, pl. lxxxviii. figs. 10, 11 (1878).

Borneo (*Low*).

This species is known to me only by the type in the British Museum.

PORITIA PHILURA, sp. n. (Plate XXXII. fig. 1 ♂.)

♂. Upperside jet-black, with brilliant greenish-blue patches and spots arranged much as in *Simiskina pharyge*, Hew., but generally larger; the central streak in the fore wing, which in *S. pharyge* is comparatively straight, is bent upwards at the base of the first median nervule and occupies the upper half of the cell: costal margin of hind wing from base nearly to apex broadly pale orange; tuft of hairs near base black. Underside uniform yellowish buff: fore wing with a thin dark streak at the end of the cell, a central irregular line composed of minute white spots inwardly bordered with black, halfway between this and the margin a faint parallel line composed of dull reddish lunules, a reddish anteciliary line; cilia black: hind wing as described above, but the first two spots of the central line which commences on the costal margin large and distinct, a narrow black line inwardly bordering the reddish anteciliary line, and within that towards the anal angle a greyish sinuous line; cilia black at the tips of the nervules, greyish in between. Head, thorax, and abdomen black above, yellowish beneath; legs black, spotted with yellow above, yellow below.

Expanse $1\frac{2}{5}$ inch.

Kina Balu (*Waterstr.*). Type Mus. Staud.

Dr. Staudinger has sent me this distinct species and writes that it is unique. So far as I can see it agrees with *Poritia* in neuration, but is without the tuft of long hairs at the base of the submedian nervure of the hind wing, which is present in typical *Poritia*, nor has it the tuft of hairs below the cell which is said to be a distinctive character of *Simiskina*. *P. philura* is distinguished from *S. pharyge* on the upperside by the yellow costal margin of the hind wing, and is very different below.

SIMISKINA, Distant.

SIMISKINA PHARYGE.

Poritia pharyge, Hew. Trans. Ent. Soc. 1874, p. 345; Ill. Diurn. Lep. *Lyc.*, p. 215, pl. lxxxviii. figs. 8, 9, ♂.

Simiskina pharyge, de Nicév. Journ. Bombay Nat. Hist. Soc. 1891, p. 361, pl. F. fig. 11, ♀.

Labuan (*Wahnes*).

Specimens from Labuan, as also one from Java in our collection, agree well with Hewitson's type from Borneo. I have described below a new genus and species of this group from the Philippine Islands.[1]

PITHECOPS, Horsf.

PITHECOPS HYLAX.

Papilio hylax, Fab. Syst. Ent. p. 526 (1775).

Kina Balu (*Waterstr.*); Labuan near Banjarmasin, S.E. Borneo.

Mr. Doherty has also taken this species in Borneo (*vide* Butt. Ind. iii. p. 50).

NEOPITHECOPS, Distant.

NEOPITHECOPS ZALMORA.

Pithecops zalmora, Butl. Cat. Fab. Lep. B. M. p. 161 (1869).
Cupido talmora, Druce, P. Z. S. 1873, p. 348.

Labuan (*Low*); S.E. Borneo (*Doherty*).

SPALGIS, Moore.

SPALGIS EPIUS.

Lucia epius, Westw. Gen. Diurn. Lep. vol. ii. p. 502, pl. lxxvi. fig. 5 (1852)[2].

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[1] PORISKINA, gen. nov.

Allied to *Poritia*, but with two subcostal nervules only to the fore wing; the first, which is emitted about the middle of the cell, is very short and runs into the costal nervure, the second is emitted about halfway between the first and the end of the cell. Two distinct tufts of hair in the cell of the hind wing; the upper one, which is composed of much the longest hairs, is placed close to the subcostal nervure, whilst the lower, which is smaller but very distinct, lies close to the median nervure a short distance from the base.

PORISKINA PHAKOS, sp. n. (Plate XXXIV. fig. 15 ♂.)

♂. Upperside pale cærulean blue, non-iridescent; fore wing—costal narrowly, apex and outer margin rather broadly dull brown; hind wing—costal and anal margins pale grey, outer margin rather narrowly dull brown: upper tuft of hairs white, lower tuft brown. Underside greyish white: fore wing glistening along inner margin up to lower median nervule; a pale orange spot in the cell at base of first median nervule, a narrow streak at the end of the cell and beyond, at about the middle a broken irregular band composed of irregular pale orange spots with narrow brown edges, and beyond this two exceedingly sinuous brown lines: hind wing as fore wing, but with an additional band of pale yellow spots placed about halfway between the base and the median band. Head, thorax, and abdomen bluish above, white beneath. Legs white, spotted with black.

Expanse $1\frac{3}{5}$ inch.

Hab. Mindanao, Davao (*Platen*). Mus. Staud.

Dr. Staudinger has sent me this very distinct insect, which is not closely allied to any with which I am acquainted. It should be easily distinguished from all others by the absence of the third subcostal nervule, and by the non-iridescent blue.

[2] I have carefully examined the type of *S. dilama*, Moore, which is in Messrs. Godman and Salvin's collection, and find that it differs only from Sikkim specimens in the ground-colour being slightly paler. It is in very poor condition, and I quite fail to see how Mr. Moore can have considered it in any way distinct.

Kina Balu (*Waterstr.*).

Dr. Staudinger has sent me a male which differs from the typical form only by the disc of the fore wing below the white spot being slightly greyish.

SPALGIS NUBILUS.

Spalgis nubilus, Moore, P. Z. S. 1883, p. 522; Distant & Pryer, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 266 (1887).

Sandakan (*Pryer*); Labuan (*Waknes*).

TARAKA, de Nicéville.

TARAKA HAMADA.

Miletus hamada, Druce, Cist. Ent. vol. i. p. 361 (1875).

Kina Balu (*Waterstr.*).

The type of this species is now in Messrs. Godman and Salvin's collection.

MEGISBA, Moore.

MEGISBA MALAYA.

Lycæna malaya, Horsf. Cat. Lep. E. I. C. p. 70 (1828).

Sandakan (*Pryer*).

M. malaya is also recorded from Borneo by Mr. de Nicéville, who states that it is the tailed form which occurs there (Butt. Ind. iii. pp. 61, 62).

CYANIRIS, Dalman.

I have no less than eight species of this genus to deal with, and after carefully examining all the described species, I am only able to recognize one as identical with one of these forms, viz. *C. lambi*, Distant, and am compelled with some reluctance to propose names for the remainder, notwithstanding Dr. Holland's remarks about them in the Proc. Boston Soc. Nat. Hist. 1890, p. 70.

CYANIRIS DILECTISSIMA, sp. n. (Plate XXXII. figs. 2 ♂, 3 ♀.)

Lycæna dilectissima, Staud. MS.

♂. Upperside allied to *C. albocæruleus*, Moore, but darker and greyer blue; the fore wing with the outer margin and apex narrowly black (about as in *C. argiolus*, Linn.), and with only a few whitish scales on the costa and on the disc: hind wing pure white, dusted with blue (thickly) at the base, along the outer margin, inside the black anteciliary line, and along the nervules; cilia pure white. Underside with spots and markings as in *C. albocæruleus*, but larger, blacker and more distinct, and with distinct black linear marks closing the cells of both wings: fore wing with a marginal row of black spots; hind wing with a similar row larger and blacker.

♀. Upperside differs from that sex of *C. albocæruleus* by the black outer marginal border of fore wing being broader and less clearly defined, and by the costal margin of hind wing being broadly (to the subcostal nervure) greyish black from base to apex.

Underside as male. The black marginal spots of the hind wing are seen through to the upper surface in both sexes, but are more noticeable in the female. The bases of both wings on upperside in female are slightly dusted with bluish scales.

Expanse, ♂ $1\frac{3}{10}$, ♀ $1\frac{3}{10}$–$1\frac{1}{7}$ inch.

Kina Balu (*Everett* and *Waterstr.*). Mus. Staud. and Druce.

C. dilectissima should be distinguished by its narrow black apex, by the absence of the white disc on the fore wing on its upperside, and by the distinct rows of black spots on the margins and the generally larger markings below. It is also allied to the recently described *C. ceyx*, de Nicéville, from Java[1].

CYANIRIS PUSPA.

Polyommatus puspa, Horsf. Cat. Lep. E. I. C. p. 67 (1828).

Cupido cagaya, Druce, P. Z. S. 1873, p. 348.

Cyaniris lambi, Distant & Pryer, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 266 (1887).

Labuan (*Low*); Sandakan (*Pryer*).

I have seen one specimen only of this species from Borneo, a male, which was identified by Mr. Herbert Druce as *C. cagaya*, Feld., and is now in Messrs. Godman and Salvin's collection. This specimen is identical with one from Malacca, also in these gentlemen's possession, marked "*C. lambi*" by Mr. Distant. I do not know how *C. cagaya* can be distinguished from *C. puspa*. The broad-bordered and the narrow-bordered forms occur together in the Philippine Islands, both with and without white discs. What I take to be the typical *C. cagaya* is the broad-bordered form of the 'Novara' Voyage, and which now stands in the Felder collection marked "*lalage*," which appears to have been affixed to it in error, as I could find no specimen marked "*cagaya*."

CYANIRIS PLACIDULA, sp. n. (Plate XXXII. figs. 6 ♂, 7 ♀.)

♂. Closely allied to *C. placida*, de Nicév. Upperside darker blue, with the outer margins more broadly black and less sharply defined inwardly; costal margin of hind wing much more broadly black. Underside differs from *C. placida* by the discal band of spots in the fore wing being more in line and, towards the outer angle, reaching close to the submarginal line. The submarginal lines in both wings are composed of less distinctly crescent-shaped striæ than in *C. placida*.

♀. Upperside broadly black-bordered, bluish on the discs, both wings with a black mark closing the cell; fore wing with a whitish blotch beyond the end of the cell; hind wing with a marginal row of lunules enclosing black marginal spots. Underside as male.

Expanse, ♂ $1\frac{1}{2}$–$1\frac{3}{10}$, ♀ $1\frac{1}{5}$ inch.

Kina Balu (*Waterstr.*). Type Mus. Staud. and Druce.

Apparently plentiful where it occurs. There seems to be practically no variation, judging from the specimens I have examined.

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[1] *C. ceyx*, de Nicév. Journ. Bomb. Nat. Hist. Soc. vol. vii. p. 329, figs. 6, 7 (1892).

CYANIRIS LUGRA, sp. n. (Plate XXXII. fig. 5 ♂.)

♂. Allied to *C. placida*, de Nicév., much smaller. Upperside uniform dull greyish silvery blue, margins more narrowly black, cilia greyish. Underside pale brownish grey, with the spots and markings arranged as in *C. placida*, but with the exception of two on the costa and the marginal row, also on the hind wing, which are blackish, of a dull brownish grey, but slightly darker than the ground-colour.

Expanse $1\frac{1}{10}$ inch.

Kina Balu (*Waterstr.*). Mus. Staud. and Druce.

This is a small, dull-coloured butterfly, which appears to be distinct from any described. I have not seen the female. Below will be found described another species which I believe to be new[1].

CYANIRIS SELMA, sp. n. (Plate XXXII. fig. 10 ♂.)

♂. Allied to *C. cælestina*, Kollar. Upperside pale shining silvery blue, brighter and more shining than in that species; black apical border slightly wider. Underside: spots arranged as in *C. cælestina*, with the addition of faint marginal rows of spots which are most conspicuous in the hind wing. The two black spots close to the costal margin on the hind wing, which in *C. cælestina* are usually not more noticeable than the other spots on the wing, are in this species larger and more conspicuous than any others. The marginal row of spots on the hind wing shows through to the upper surface. Cilia shorter.

Expanse $1\frac{1}{10}$ inch.

Kina Balu (*Waterstr.*). Type Mus. Staud.

C. selma should be easily distinguished from *C. cælestina* by its brighter blue upperside. I have not seen the female.

CYANIRIS STROPHIS, sp. n. (Plate XXXII. fig. 4 ♂.)

♂. Upperside deep lavender-blue, colour of *C. placida*, which it closely resembles, having, however, narrower and more even black margins. The underside exactly as in *C. dilectissima*, mihi, but the spots and markings not quite so deeply black.

Expanse $1\frac{3}{10}$ inch.

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[1] **CYANIRIS PHUSTE**, sp. n. (Plate XXXIV. fig. 17 ♂.)

Upperside dull violaceous blue, rather greyer than *C. placida*, which it resembles on the upperside, with rather broader black borders. Underside greyish white, with a linear dark streak closing the cell of each wing, a very faint, scarcely perceptible zigzag line crossing the wings beyond the middle, then a darker submarginal line composed of crescent-shaped marks enclosing a marginal row of dark spots common to both wings and darkest towards anal angle of hind wing; a very fine anteciliary dark line to both wings. Cilia grey, with dark spots at the termination of the nervules.

Expanse $1\frac{1}{4}$ inch.

Hab. Dili (*W. Doherty*). Type Mus. Druce.

This is not the *C. duponchellii*, Godt., which we have also from Dili, obtained by Mr. Doherty, and which is close to *C. puspa* on the upperside, and has the lower spot of the discal series on the fore wing below enlarged into a considerable blotch.

Kina Balu (*Waterstr.*). Type Mus. Staud.

Can this be a seasonal form of *C. dilectissima*? On the underside they are almost identical, but on the upperside the hind wings are strikingly different.

Cyaniris plauta, sp. n. (Plate XXXII. figs. 8 ♂, 9 ♀.)

Lycæna plauta, Staud. MS.

♂. Upperside deep lavender-blue, colour of *C. placida*, with black costa, apex, and outer margin much as in *Lycænopsis haraldus*, Fab. (to which it bears a general resemblance, without possessing the beautiful opalescent shading of that species), but the blue area more extensive: hind wing deepl avender-blue, outer margin very narrowly black, with a marginal row of elongate black spots; costal margin broadly black to near its apex, where it becomes white, a large white patch below this occupying nearly the whole of the subcostal interspace except the black outer margin: anal fold whitish. Underside: ground-colour white tinged with pale yellow as in *L. haraldus*, with black spots arranged much as in *C. placida*, large and distinct; the black spot on the middle of the costa of hind wing is unusually large and conspicuous.

♀. Upperside resembling *C. albidisca*, Moore, ♀, but without the black streak closing the cell of the fore wing, and with the whole of the white area of the fore wing as well as the abdominal half of the hind wing shot with beautiful opalescent blue; the black marginal spots on hind wing become more separated and distinct towards the anal angle. Underside as male.

Expanse, ♂ $1\frac{3}{5}$, ♀ $1\frac{3}{5}$–$1\frac{3}{10}$ inch.

Kina Balu (*Waterstr.* and *Everett*); Labuan (*Low*). Mus. Staud. and Druce.

Some females from Kina Balu are not so strongly marked on the underside as others, whilst a female from Labuan in Messrs. Godman and Salvin's collection has the outer margin of hind wing above broadly black-bordered. It seems a distinct species, and the yellowish tinge of the underside may perhaps serve to link it with the species which I have placed in the next genus.

Cyaniris ripte, sp. n. (Plate XXXII. fig. 11 ♂.)

♂. Upperside bright shining violaceous blue, with a pinkish tinge and black margins about equal to those of *C. placida*. Underside pale brown, slightly paler only than the ground-colour of *Jamides bochas*, Cr., ♀, with sordid-white-edged spots and markings, which are rather darker brown than the ground-colour, arranged as in *C. puspa*, with the addition of a double spot in the centre of the cell of the fore wing. The black spot just beyond the middle of the costal margin on the hind wing is large and prominent.

Expanse 1–$1\frac{1}{5}$ inch.

Labuan (*Low*). Type Mus. G. & S.

C. ripte differs from all others in the shade of blue on the upperside, and is, I believe, the only *Cyaniris* known which has a spot in the cell of the fore wing below; this spot, I find, is not always double as described above, sometimes single, but always distinctly present.

LYCÆNOPSIS, Feld.

This genus is very, perhaps too close to *Cyaniris*, under which name it has been sunk by Mr. Distant. On bleaching the wings of a male the only differences in venation which I can discover are in the hind wing, in which the first median nervule and the subcostal nervule are both longer than in *C. argiolus*, Linn., being emitted higher up the wing. This character, however, is probably not of much importance.

LYCÆNOPSIS HARALDUS.

Papilio haraldus, Fab. Mant. Ins. vol. ii. p. 82 (1787).

Cupido cornuta, Druce, P. Z. S. 1873, p. 349, pl. xxxii. fig. 5, ♀.

Labuan (*Low* and *Wahnes*).

Apparently a scarce insect in Borneo, as I have seen three female specimens only—two, including the type of *C. cornuta*, which does not differ in any way from females from Malacca and Java, in Messrs. Godman and Salvin's collection, and one sent by Dr. Staudinger.

ZIZERA, Moore.

Zizera is a genus which appears to be very poorly represented in Borneo, and I am able to include only one species here.

ZIZERA OTIS.

Papilio otis, Fab. Mant. Ins. vol. ii. p. 73 (1787).

Zizera lysizone, Distant & Pryer, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 267 (1887).

Labuan (*Wahnes* and *Waterstr.*); Sandakan (*Pryer*).

Bornean specimens show the same amount of variation on both surfaces as obtains in the species from other localities.

LYCÆNESTHES, Moore.

LYCÆNESTHES EMOLUS.

Polyommatus emolus, Godt. Enc. Méth. vol. xix. p. 656 (1823).

Pseudodipsas bengalensis, Druce, P. Z. S. 1873, p. 351.

Labuan (*Low* and *Wahnes*); S.E. Borneo (*Wahnes*).

LYCÆNESTHES LYCÆNINA.

Lycænesthes lycænina, Feld. Verh. zool.-bot. Gesellsch. Wien, vol. xviii. p. 281 (1868); Distant & Pryer, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 267 (1887).

S.E. Borneo (*Wahnes*); Sandakan (*Pryer*).

We also possess a specimen, labelled "Borneo," which was formerly in the Rev. Mr. Murray's collection, and Mr. de Nicéville records it Butt. Ind. etc. p. 130 (1890).

NIPHANDA, Moore.

NIPHANDA RETER, sp. n. (Plate XXXII. fig. 12 ♂.)

♂. Upperside shining dark violet as in *N. cymbia*, de Nicév., which it closely resembles. Underside: ground pure white with dark brown spots on the fore wing as in that species, but larger and more distinct, especially that one which lies beyond the basal streak, which is nearly twice as large as in *N. cymbia*. Hind wing with the spots arranged as in *N. cymbia*, but much larger; and without the brown mottling of that species.

Expanse $1\frac{3}{10}$ inch.

Kina Balu (*Waterstr.*). Mus. Staud. and Druce.

At first sight the underside of this insect presents a very different appearance from *N. cymbia*, but on closer examination the spots appear to be similarly placed. The absence of all mottlings from the hind wing and the much larger spots, together with the pure white ground, should distinguish it.

LUTHRODES, gen. nov.

Allied to *Talicada*, Moore, from which it differs by the costal nervure of the fore wing being bent towards the first subcostal nervule, but entirely free for its whole length—not anastomosed as in that genus—and reaching the margin considerably before the apex of the cell.

Type *Polyommatus cleotas*, Guér.

I find on bleaching the wings that the species referred by myself (P. Z. S. 1891, p. 358, & 1892, p. 436) and others to *Talicada* are not strictly congeneric and present the differences in neuration described above. All the species of *Luthrodes* are tailless excepting *L. mindora*, Feld., which is tailed like *J. nyseus*, Guér.

LUTHRODES MINDORA.

Lycæna mindora, Feld. Reise Nov., Lep. ii. p. 277, t. 34. figs. 9, 10 (1865).

Cupido aruana, Druce, P. Z. S. 1873, p. 349 (nec Feld.).

Talicada mindora, Distant & Pryer, Ann. Mag. Nat. Hist. ser. 5, vol. xix. p. 267 (1887).

Labuan (*Low*); Sandakan (*Pryer*).

The two specimens which I have seen from Borneo are now in Messrs. Godman and Salvin's collection. They were incorrectly referred to *L. arruana*, Feld., which has larger spots below and is without tails. They are identical with specimens from Mindoro before me. Of course in the general arrangement of the nervules *Luthrodes* scarcely differs from *Lycæna*, *Cyaniris*, and others, but the peculiarity of coloration seems to suggest a distinctive feature, being intermediate between those genera and *Talicada*.

EVERES, Hübn.

EVERES ARGIADES.

Papilio argiades, Pallas, Reise, vol. i. App. p. 472 (1771).
Polyommatus lacturnus, Godt. Enc. Méth. ix. p. 66 *a* (1823).
Cupido lacturnus, Druce, P. Z. S. 1873, p. 348.

Kina Balu (*Waterstr.*); Labuan (*Low*).

I have no hesitation in placing *P. lacturnus*, Godt., as a synonym of *E. argiades* after examining specimens from Timor. The species is also a very common one in New Guinea, where the females are sometimes pale grey with darker borders, and where it varies much in size, one male in Messrs. Godman and Salvin's collection measuring only slightly more than $\frac{1}{2}$ inch.

NACADUBA, Moore.

NACADUBA PAVANA.

Lycæna pavana, Horsf. Cat. Lep. E. I. C. p. 77 (1828).

Kina Balu (*Waterstr.*); Sandakan (*Pryer*); Labuan (*Low*).

Specimens from Kina Balu are darker on both surfaces than those from the other localities.

NACADUBA LUGINE, sp. n. (Plate XXXII. fig. 15 ♂.)

Cupido pactolus, Druce, P. Z. S. 1873, p. 348 (nec Feld.).

♂. Allied to *N. macrophthalma*, Feld.; rather larger. Upperside brighter and more violaceous blue, and with scarcely any silvery gloss. Underside pale rufous brown, with the fasciæ narrower, paler, and in the fore wing much more irregularly broken, so that there is no distinct Y. The black spot between the lower median nervules is larger and more broadly edged with rich dark orange.

Expanse 1$\frac{3}{5}$ inch.

Labuan (*Low*). Type Mus. G. & S.

On comparing this species with the type of *L. pactolus*, Feld., to which it was referred by Mr. Herbert Druce in his paper on Bornean Butterflies, I find that it is quite distinct, and, as I can find nothing else like it, am compelled to describe it as new.

Messrs. Godman and Salvin's collection contains another small female specimen of a species belonging to this group, which on the upperside resembles that sex of *N. atrata*, Horsf., and on the underside is much like *N. pavana*, Horsf., but until the male is discovered I do not care to propose a name for it. It expands 1$\frac{1}{10}$ inch and is from Sandakan.

NACADUBA ANGUSTA.

Cupido angusta, Druce, P. Z. S. 1873, p. 349, pl. xxxii. fig. 9.

Labuan (*Low*).

Messrs. Godman and Salvin's collection contains the type of this species. The figure given is quite useless and misleading and hardly bears any resemblance to the insect. In it the wings appear to be dark grey with yellow borders and black markings and spots, whereas the ground-colour is very pale yellowish grey with pale brown fasciæ and a double row of black marginal spots to each wing; the two spots nearest to the anal angle sprinkled with blue scales. The upperside is dull violaceous silvery blue. Possibly *N. kerriana*, Distant, is conspecific with *N. angusta*, but unfortunately I have not a specimen for examination. The underside of the figure given in Rhop. Malay. appears to agree well with that of *N. angusta*, but the upperside has a broader black outer margin.

N. azureus, Röber, as figured by Herr Semper (Reise Philip. Insel. p. 177, pl. xxxiii. figs. 1, 2), and which we possess from S. Celebes (*Doherty*), is a closely allied species. Herr Röber's figure and this one, however, do not agree very well.

NACADUBA ATRATUS.

Lycæna atratus, Horsf. Cat. Lep. E. I. C. p. 78 (1828).

Cupido akaba, Druce, P. Z. S. 1873, p. 350.

Kina Balu (*Waterstr.*); Labuan (*Low*); S.E. Borneo, near Banjarmasin (*Wahnes*).

Kina Balu specimens are slightly darker on the upperside than those from Labuan and S.E. Borneo. I have examined the type of *C. akaba*, and can find no character to distinguish it.

NACADUBA BEROË.

Lycæna beroë, Feld. Reise Nov., Lep. ii. p. 275, pl. xxxiv. fig. 36 (1865).

Nacaduba beroë, Distant & Pryer, Ann. Mag. Nat. Hist. ser. 5, vol. xix. p. 267 (1887).

Sandakan (*Pryer*).

I include *N. beroë* here on the authority of Messrs. Distant and Pryer. Typically, I think it can be distinguished from *N. atratus* by the paler ground-colour of the underside and by the fascia being much wider.

NACADUBA BHUTEA.

Nacaduba bhutea, de Nicév. J. A. S. B. vol. lii. pt. 2, p. 72, pl. i. fig. 13 (1883).

Kina Balu (*Waterstr.* and *Everett*); Labuan (*Low*).

The ground-colour of the Bornean examples I have examined is ochreous on the underside.

NACADUBA ARDATES.

Lycæna ardates, Moore, P. Z. S. 1874, p. 574, pl. lxvii. fig. 1.

Sandakan (*Pryer*); Labuan (*Low*).

The tailed form only.

NACADUBA ALUTA. (Plate XXXII. figs. 13 ♂, 14 ♀.)

Cupido aluta, Druce, P. Z. S. 1873, p. 349, pl. xxxii. fig. 8.

Sandakan (*Pryer*); Labuan (*Low & Wahnes*).

The figure given in the P. Z. S. is a very bad one and bears but slight resemblance to the insect. It is, in my opinion, although allied to *N. ardates*, quite distinct. On the upperside it is much like *N. atratus* (dry-season form) in colour and general appearance, whilst *N. ardates* is a totally different shade, being dark violaceous brown. On the underside, although the markings are placed as in *N. ardates*, they are always pure white. The female is dull blackish brown on the upperside, with the disc of the fore wing light shining blue and with an outer-marginal row of black spots on the hind wing most conspicuous; the underside is paler in colour than the male, and the double marginal row of black lunules is more distinct. Mr. Distant has probably figured and described specimens of *N. ardates* as *N. aluta* in his 'Rhopalocera Malayana.' I hope the above remarks will enable the species to be distinguished when met with. It is not an uncommon insect in Borneo, but I have seen no specimens from any other locality. Messrs. Godman and Salvin possess the type and other specimens, whilst Dr. Staudinger has also sent it. The type measures fully 1 inch, whilst the figure barely reaches $\frac{4}{5}$ inch.

Messrs. Distant and Pryer record *N. aluta* from Sandakan (Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 267), but as Mr. Distant has not recognized the species, probably not having seen the type, without which it was of course quite impossible to do so, they are probably referring to *N. ardates*[1].

NACADUBA ANCYRA.

Lycæna ancyra, Feld. Reise Nov. Lep. p. 276, t. 34. fig. 5 (1865).

Cupido almora, Druce, P. Z. S. 1873, p. 349, pl. xxii. fig. 7.

Nacaduba pseustis, Doherty, J. A. S. B. vol. lx. pt. ii. p. 182 (1891).

Kina Balu (*Waterstr. & Everett*); Labuan (*Low*); S.E. Borneo (*Doherty*).

The figure given of *C. almora* is misleading. I have examined the type of *L. ancyra* in the Felder collection and find that *C. almora*, Druce, the type of which (♂) is in Messrs. Godman and Salvin's collection, is identical with it. Mr. Doherty has also described it as *N. pseustis*[2].

UNA, de Nicév.

Butt. Ind. etc. iii. p. 51 (1890).

UNA USTA.

Zizera ? usta, Distant, Ann. & Mag. Nat. Hist. ser. 5, vol. xvii. p. 531 (1886); Rhop. Malay. p. 454, pl. xliv. fig. 5 (1886).

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[1] Dr. Staudinger has kindly sent me for examination the type of his *Lycæna ardeola* from Palawan (Iris, ii. p. 97, 1889), which must be sunk as a synonym of *N. dana*, de Nicév., with which it is identical.

[2] *N. amaura*, H. H. Druce (P. Z. S. 1891, p. 361, pl. xxxi. fig. 10), from the Solomon Is., should be sunk as a synonym of *N. ancyra*, as also probably should *N. gaura*, Doherty, from Sumba (J. A. S. B. vol. lx. p. 181, 1891), which is stated (p. 182) to be something like *Lycæna palmyra*, Feld. I cannot, however, see any resemblance. An error has been made in numbering the figures on plate ii. in this part of the J. A. S. B.; fig. 9 (pl. ii.) should read fig. 11, and *vice versa*, as is evident from the descriptions on pp. 182–184. *N. maniana*, H. H. Druce (id. pl. xxxi. fig. 9), is also very close and should perhaps be considered a slight local race.

Kina Balu (*Waterstr.*).

Dr. Staudinger has sent me a fine specimen (♂) of what I take to be this interesting species; it differs slightly, however, from Mr. Distant's description of the underside as follows:—The fore wing has only one small fuscous spot in the middle of the cell; on the hind wing the fuscous spot beneath the outermost black spot on the costal margin and the fuscous spot in the cell are both wanting.

The genera *Una*, de Nicév., and *Prosotas*[1], mihi, agree very closely in venation, but have a very different general appearance, whilst the palpi of *Prosotas* are shorter and the antennæ less spatulate.

JAMIDES, Hübn.

JAMIDES BOCHUS.

Papilio bochus, Cr. Pap. Exot. vol. iv. p. 210, pl. cccxci. figs. C, D (1782).

Kina Balu (*Waterstr.*); Labuan (*Low*).

All the Bornean males I have examined have the blue area of the fore wing much contracted.

LAMPIDES, Hübn.

After working carefully through the described species of this genus, I find four Bornean species which I am unable to match with any of them, and am, though with considerable reluctance, obliged to describe them here. Although Mr. de Nicéville has paid much attention to the genus, and, having seen some of Felder's types, has, in a paper (Journ. Bombay Nat. Hist. Soc. pp. 364–368, 1891) published after his 'Butterflies of India, etc,' considerably altered some statements made in that work, much yet remains to be done to put the genus into a satisfactory condition; and until some one has the opportunity to carefully compare the types of the numerous species described by Herr Röber in 'Iris' i., and those of Felder and others, I fear it will still be so. After carefully studying Herr Röber's figures I am of opinion that they are by far the best yet published of this difficult group and not, as has been stated, difficult to make out.

Group I.[2]

LAMPIDES ELPIS.

Polyommatus elpis, Godt. Enc. Méth. vol. xix. p. 654 (1823).

Lampides elpis, Distant & Pryer, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 267 (1887).

Cupido alecto, Druce, P. Z. S. 1873, p. 348.

Kudat; Sandakan and Elopura (*Pryer*); Kina Balu (*Waterstr.*); Labuan (*Low*); Lawas (*Everett*).

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[1] *Prosotas*, mihi, P. Z. S. 1891, p. 366. Type *P. caliginosa*, mihi, from the Solomon Is.

[2] I have arranged the species here according to the groups given by M. de Nicéville in J. B. Nat. Hist. Soc. pp. 365, 366 (1891).

I am unable to say how the true *alecto*, Feld., differs from this species, not having seen the type, but the specimens now before me from Labuan, referred to that species by Mr. Herbert Druce, are undoubtedly *L. elpis.*

Mr. de Nicéville (Butl. Ind. etc. vol. iii. p. 165) appears to have wrongly identified *L. pseudelpis*, Butler, as on examination of the type I find that the transverse striæ are arranged as in true *L. elpis*, but that the lower portion of No. 1 is slightly out of line and nearer the base; but there are no other differences, and I quite agree with Mr. Distant that it is a form of *L. elpis.* On the upperside the type of *L. pseudelpis* has a faint black linear border only.

LAMPIDES LIMES, sp. n. (Plate XXXII. fig. 16 ♂.)

♂. Upperside rich shining pale blue, much like *L. suidas*, Feld., but with the white bands of the underside showing more distinctly through than in that species; outer margins very narrowly black as in *L. suidas.* Underside: ground-colour rather dark grey, with white bands arranged much as in *L. elpis*—fore wing, the 1st and 2nd with white spots over them close to the costal margin; the 3rd and 4th much broken, both with their upper segments out of line and placed about halfway between the 2nd and 3rd and 3rd and 4th bands respectively; the 4th with two white spots above it close to the costal margin, one each side. Marginal and submarginal bands as in *L. elpis.* Hind wing with white bands arranged as in *L. elpis*, but more broken into segments.

Expanse $1\frac{7}{10}$ inch. Type Mus. Staud.

Kina Balu (*Waterstr.*).

L. limes is a much richer colour on the upperside than *L. elpis*, and is, I believe, the only species of this group in which the 1st and 2nd bands of the fore wing are continued to the costal margin by separated white spots.

LAMPIDES VIRGULATUS, sp. n. (Plate XXXII. fig. 17 ♂.)

♂. Upperside much like *L. philatus*, Snell., having the dull appearance of that species, but bluer. Underside rather darker grey than in *L. limes*, with distinct, narrow, and comparatively straight white bands: the 1st and 2nd are parallel, and have two small spots between them close to the costal margin; the 3rd is very short, and extends from the costal margin to the upper discoidal; the 4th extends to the 2nd median nervule, and has a small spot each side of it close to the costa; the 4th is short and extends from the upper discoidal to the 3rd median nervule. The remaining bands are placed as in *L. elpis.* Hind wing as in *L. elpis*, but the white bands are all straighter.

Expanse $1\frac{3}{10}$ inch.

S.E. Borneo, near Banjarmasin (*Wahnes*). Type Mus. Staud.

Although this species is much like *L. philatus* on the upperside, it is totally different on the underside. It appears to be distinct, and I hope can be recognized from the description given above.

LAMPIDES CÆRULEA. (Plate XXXII. fig. 19 ♀.)

Cupido cærulea, Druce, P. Z. S. 1873, p. 349, pl. xxxii. fig. 6.

Lampides cærulea, H. H. Druce, Ent. Mo. Mag. ser. 2, vol. v. p. 9 (1894).

Lampides bochides, de Nicév. J. B. Nat. Hist. Soc. 1891, p. 367, pl. F. fig. 15.

Kina Balu (*Waterstr.*); Elopura (*Pryer*); Labuan (*Low*); S.E. Borneo, near Banjarmasin (*Wahnes*).

Two specimens before me, which I take to be females of this species, are paler shining blue on the upperside and the outer margins of both wings are evenly black bordered; the apex of the fore wing widest. On the underside the ground-colour is paler than the male, and the bands, which are arranged exactly as in the male, are wider and pure white.

LAMPIDES ABDUL.

Lampides abdul, Distant, Rhop. Malay. p. 456, pl. xliv. fig. 22 (1886); Distant & Pryer, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 267 (1887).

Sandakan (*Pryer*).

Mr. de Nicéville states that this species belongs to this group (Butt. Ind. etc. iii. p. 166, 1890). I have not seen a specimen.

Group II.

LAMPIDES OSIAS.

Plebeius osias, Röber, Iris, i. p. 56, pl. v. fig. 17 (1886).

Lycæna amphyssina, Staud. Lep. Palawan, p. 100, t. i. fig. 4, ♀ (1889).

Kudat; Labuan (*Low*); Sibutu (*Everett*).

Dr. Staudinger has kindly sent me the types of his *L. amphyssina*, which do not differ in the slightest from *L. osias*, which, as has been already pointed out by Herr Semper[1], must be sunk as a synonym[2].

[1] Schmett. Phil. Insel. p. 179 (1889).

[2] We possess a good series of a species belonging to this group, which I can find nowhere described, and propose to call it *L. emetallicus*, sp. n.

Allied to *L. amphissa*, Feld., ♂ ♀. Upperside as that species. Underside: ground-colour darker, the lines narrower and more irregular; the ground-colour between the two submarginal zigzag lines of the fore wing distinctly darker than the rest of the wing. Hind wing: a very small orange spot close to the margin, just above the submedian nervure; the black spot between the 1st and 2nd median nervules only, crowned with orange and without any metallic-blue scales whatever. Expanse as *L. amphissa*. Batchian (*Doherty*). Type Mus. Druce, also in Mus. S. & G.

Allied to *L. amphissa*, Feld., and *L. amphissina*, Grose Smith[a], and also to *L. lucianus*, Röber, from which latter it differs in the arrangement of the white lines in the fore wing; but differing, so far as I know, from all others in the absence of all metallic scales near the anal angle of the hind wing below.

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[a] *L. amphissina*, Grose Smith, Novitates Zoologicæ, vol. i. p. 577, 1894. Is not this name too near to "*amphyssina*" to stand?

Group III.

LAMPIDES CELENO.

Papilio celeno, Cr. Pap. Exot. vol. i. pl. xxxi. figs. C, D (1775).
Cupido celeno, Druce, P. Z. S. 1873, p. 348.
Lampides œlianus, Distant & Pryer, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 267 (1887), et auctores.

Labuan (*Low*); Sarawak (*Everett*).

Mr. de Nicéville appears to consider *L. celeno*, Cr., distinct from *L. œlianus* (Journ. B. N. H. Soc. 1891, p. 366). The types of Mr. Herbert Druce's *L. agnata*[1] are before me, and are quite indistinguishable from the common form of *celeno*. The forms *alexis*, Stoll, and *conferenda*, Butl., seem to be quite unknown in Borneo[2]. I think that both Messrs. Distant and de Nicéville are wrong in placing *P.* (=*L.*) *malaccanus*, Röber, as a synonym of *L. œlianus*, as the arrangement of the white bands on the hind wing is very different, the 4th band (from the base), which in *œlianus* extends upwards to the 2nd median nervule, is in Herr Röber's figure entirely absent.

LAMPIDES OPTIMUS.

Plebeius optimus, Röber, Iris, i. p. 56, pl. iv. fig. 16 (1886).

Kina Balu (*Waterstr.*); Elopura (*Pryer*); Lawas (*Everett*); Labuan (*Low*); Taganac I.

L. optimus scarcely differs from *L. cleodus*, Feld., on the upperside, and on the fore wing below the white bands are arranged as in that species, but on the hind wing the 4th band (counting from the base) does not reach the costal margin, but stops short at the subcostal nervure. The outer margin of the hind wing of the female on the upperside appears to be not so strongly marked as in that sex of *L. cleodus*.

LAMPIDES CLEODUS.

Lycæna cleodus, Feld. Reise Novara, Lep. ii. p. 272, pl. xxxiv. figs. 20, 21, 22 (1865).

Sandakan (*Pryer*).

Both sexes of this species are contained in Messrs. Godman and Salvin's collection, agreeing well with typical specimens.

LAMPIDES ZEBRA, sp. n. (Plate XXXII. fig. 18 ♂.)

♂. Upperside very pale whitish blue, shining as in *L. cleodus*, but bluer. The apex of fore wing very slightly dusky. Hind wing sometimes unmarked, sometimes with a blackish streak near the anal angle. Underside: ground-colour rather dark grey, with pure white bands arranged as in *L. celeno* in both wings, but with the orange patch darker and much more extensive.

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[1] *Cupido agnata*, Druce, P. Z. S. 1874, p. 106, pl. xvi. figs. 2–4.

[2] There are specimens in Messrs. Godman and Salvin's collection of the allied *L. evanescens*, Butl., from New Hebrides Is., which closely resemble the form *conferenda*, Butl.

♀. Upperside much like that sex of *L. cleodus*, but outer margin of fore wing generally broader brown and always without the white lunules towards the outer angle. On the hind wing the marginal spot in the first median interspace is often distinctly crowned with orange. Underside as male.

Expanse ♂ $1\frac{1}{2}$–$1\frac{7}{10}$ inch, ♀ $1\frac{2}{5}$–$1\frac{1}{2}$ inch.

Kina Balu (*Waterstr.*); Labuan (*Low*); Sarawak (*Everett*).

This is a puzzling species, and may perhaps hereafter be found to be a form of *L. celeno*, but the shining surface of the male and the unusual orange patch on the upperside which is often present in the female, markedly so in specimens from Kina Balu, seem to distinguish it. Several males from Labuan have the cilia only of the fore wing black, on the upperside.

LAMPIDES LIVIDUS, sp. n. (Plate XXXII. fig. 20 ♂.)

♂. Upperside uniform pale shining blue, with a decided pinkish tinge; cilia pale brownish. Underside pale greyish brown, with much broken, narrow white bands, arranged somewhat as in *L. osias*. Fore wing: a white band closing the end of the cell and another beyond it, commencing below the upper discoidal nervule and reaching the submedian nervure, missing, however, the space between the 2nd and 3rd median nervules; two parallel white bands from the subcostal nervure to the 2nd median nervule beyond the middle of the wing, and below these, commencing between them and running to the submedian nervure, another white band; two rows of indistinct parallel submarginal whitish lunules, and an anticiliary whitish line. Hind wing: bands and spots arranged much as in *L. osias*, but the submarginal row of sagittate markings (which in that species are black) scarcely definable, and but slightly darker than the ground-colour of the wing.

Expanse $1\frac{7}{10}$ inch.

Labuan (*Low*).

In shape this species differs from all others described by the much more elongate fore wing, the costa being longer, the apex more produced, and the inner margin shorter.

The type specimen, which is in Messrs. Salvin and Godman's collection, is unique.

LAMPIDES ARATUS.

Papilio aratus, Cr. Pap. Exot. vol. iv. pl. ccclxv. figs. *a*, *b* (1782).

Kina Balu (*Waterstr.*); Sandakan (*Pryer*).

♂. Quite typical. Female with brown outer marginal border to fore wing broader than the usual form from Amboina.

LAMPIDES ADANA.

Cupido adana, Druce, P. Z. S. 1873, p. 349.

Labuan (*Low*).

This is a very doubtful species, the male being indistinguishable from that sex of *L. aratus*. It may perhaps be distinguished from that species by its female, which has the brown outer margin much broader and the hind wing brown with bluish scales and hairs at the base. The females were referred by Mr. Herbert Druce (P. Z. S. 1873, p. 348) to *L. aratus*. The *P.* (=*L.*) *snelleni*, var. *batjanensis*, Röber ('Iris,' i. p. 55, pl. iv. fig. 109), is contained in Messrs. Godman and Salvin's collection, and is identical on both surfaces with the females of *L. adana*[1].

THYSONOTIS, Hübn.

THYSONOTIS SCHAEFFERA.

Lycæna schaeffera, Esch. Kotzeb. Reise, iii. p. 216, t. 5. fig. 25, *a*, *b* (1821).

Cupido schæffera, Druce, P. Z. S. 1873, p. 348.

Labuan (*Low*).

The specimens obtained by Low are the only representatives I have seen from Borneo[2].

CATOCHRYSOPS, Boisd.

CATOCHRYSOPS STRABO.

Hesperia strabo, Fab. Ent. Syst. vol. iii. pt. 1, p. 287 (1793).

Catochrysops strabo, Distant & Pryer, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 267 (1887).

Sandakan (*Pryer*); Labuan (*Low*); S.E. Borneo, near Banjarmasin (*Wahnes*).

CATOCHRYSOPS CNEJUS.

Hesperia cnejus, Fab. Ent. Syst. Suppl. p. 430 (1798).

Cupido cnejus, Druce, P. Z. S. 1873, p. 348.

Kina Balu (*Waterstr.*); Labuan (*Low*).

CATOCHRYSOPS PANDAVA.

Lycæna pandava, Horsf. Cat. Lep. E. I. Co. p. 84 (1829).

Kudat. Mus. Druce.

One female of the wet-season form.

TARUCUS, Moore.

TARUCUS WATERSTRADTI, sp. n. (Plate XXXII. fig. 21 ♀.)

♂. Upperside much like *T. theophrastus*, Fab., ♀, but with the blue area of the fore wing reaching to the outer marginal brown border. Underside perhaps nearest to *T. venosus*, Moore. Fore wing: basal streak shorter and much broader, and extending down to the submedian nervure, the streak beyond broader and placed at a greater angle, the spots beyond the middle more in line, the submarginal row distinctly separated, and the marginal row smaller. Hind wing: a broad basal streak from just below the costal margin to the anal angle; a broad streak beyond, also from the costal to the anal margin; then a series of spots as in *T. venosus*, which are more inclined to run parallel with the streaks; then a submarginal row of large distinct spots followed by a marginal row of small spots, the three upper being simply dots, the three lower gradually increasing towards the anal angle and dusted thickly with metallic green scales. The ground-colour of both wings is slightly tinged with yellowish and all the markings are black; the cilia of both wings black.

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[1] Mr. Grose Smith has lately referred a male from Humboldt Bay to *L. batjanensis*, Röber, with some doubt ('Novitates Zoologicæ,' vol. i. p. 578, 1894). It is doubtless, as he states, allied to *L. amphissa*, Feld., but has nothing to do with *L. batjanensis*.

[2] Unfortunately the figures of the neuration of this genus given by me on plate xlvii. P. Z. S. 1893 are useless, having been incorrectly drawn from the bleached wings by the artist; the first subcostal nervule has been omitted and the costal nervure drawn much too long, its extremity as shown being really part of the first subcostal.

Expanse $1\frac{1}{10}$ inch.

Kina Balu (*Waterstr.*). Type Mus. Staud.

T. waterstradti presents such differences on the underside from the Indian species, that I feel sure it is distinct.

TARUCUS PLINIUS.

Hesperia plinius, Fab. Ent. Syst. vol. iii. pt. 1, p. 284 (1793).

Lawas (*Everett*).

We possess one male obtained by Mr. Everett, which differs from Indian specimens by having broad and regular brown outer margins to both wings on the upperside, but is identical below. Messrs. Godman and Salvin's collection also contains this form from Minahassa.

CASTALIUS, Hübn.

CASTALIUS ROSIMON.

Papilio rosimon, Fab. Syst. Ent. p. 523 (1775).

Borneo (*Wahnes*).

Dr. Staudinger has sent me this species, but the precise locality is not noted. It probably came from the neighbourhood of Labuan or from the S.E. of Borneo.

CASTALIUS ETHION.

Lycæna ethion, Doubl. & Hew. Gen. Diurn. Lep. vol. ii. p. 490, pl. lxxvi. fig. 3 (1852).

Castalius ethion, Distant & Pryer, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 267 (1887).

Sandakan (*Pryer*); Labuan (*Low*, *Wahnes*, and *Waterstr.*); Lawas; Sarawak (*Everett*).

CASTALIUS ELNA.

Lycæna elna, Hew. Exot. Butt. vol. v. *Lycæna*, pl. i. fig. 8 (1876).

Cupido roxus, Druce, P. Z. S. 1873, p. 348 (nec Godt.).

Lycæna elerna, Staud. MS.

Kina Balu (*Waterstr.*); Elopura (*Pryer*); Labuan (*Wahnes* and *Low*).

The spots and bands vary in size and connections in the specimens before me, as noted by Mr. de Nicéville in Andaman examples.

CASTALIUS ROXUS.

Polyommatus roxus, Godt. Enc. Méth. vol. ix. p. 659 (1823).

Lawas (*Everett*).

We possess a single female obtained by Mr. Everett, which is my only authority for including the species here. *C. roxus* is stated by Felder and also by Mr. Doherty to have a short white band at the base of the costa on the underside of the hind wing, and is so figured by Mr. Distant in Rhop. Malay., but in all the specimens of *C. roxus* that I have examined the white streak is present in the fore wing only.

POLYOMMATUS, Latr.

POLYOMMATUS BŒTICUS.

Papilio bœticus, Linn. Syst. Nat. ed. xii. vol. i. p. 789 (1767).

Polyommatus bœticus, Distant & Pryer, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 267 (1887).

Kina Balu (*Waterstr.*, 1200–1500 m.); Sandakan (*Pryer*).

AMBLYPODIA, Horsf.

AMBLYPODIA NARADA.

Amblypodia narada, Horsf. Cat. Lep. E. I. C. p. 98, pl. i. fig. 8 (1829).

Sarawak.

A single male is contained in Messrs. Godman and Salvin's collection.

AMBLYPODIA ANITA.

Amblypodia anita, Hew. Cat. Lycæn. B. M. p. 14, pl. viii. figs. 90, 91 (1862).

Trusan (*Everett*); Labuan (*Low*).

IRAOTA, Moore.

IRAOTA ROCHANA.

Amblypodia rochana, Horsf. Cat. Lep. E. I. C. p. 108 (1829).

Deudorix timoleon, Druce, P. Z. S. 1873, p. 352 (nec Stoll).

Kina Balu (*Waterstr.*); Labuan (*Low* and *Mus. Staud.*).

A female sent by Dr. Staudinger measures $2\frac{1}{20}$ inches. I also quite fail to see how Mr. Distant's *I. boswelliana* differs from this species.

IRAOTA NILA. (Plate XXXIII. fig. 1 ♂.)

Iraota nila, Distant, Rhop. Malay. p. 462, pl. xliv. fig. 24 ♀ (1886); de Nicév. Butt. Ind. etc. iii. p. 217 (1890).

♂. Upperside very dark uniform purplish black; inner margin of fore wing pale brown. Both wings sparingly dusted between the nervules on the discs with bright green scales which change to blue in some lights. Thorax and abdomen black, covered with greenish hairs. Two tails of about equal length, tipped with white, one on the submedian nervure, the other on the first median nervule. Underside as male.

Kina Balu (*Waterstr.*).

I have received several females from Kina Balu, which agree well with Mr. Distant's figure of the underside, but the outer margins above are very narrowly black, and the male described above which is in Dr. Staudinger's collection. The male agrees in neuration with the male *Iraota*, and has four subcostal nervules like it, whilst the female has but three. The lower discoidal nervule in both sexes originates from the upper discoidal, and in Mr. Distant's figure is incorrectly drawn, as also are the antennæ. As has been pointed out by Mr. de Nicéville, the name *nila* has already been used for a species of this genus by Kollar; but as his name is a synonym of *I. timoleon*, Stoll, it may be used for Mr. Distant's species.

SURENDRA, Moore.

SURENDRA PALOWNA.

Amblypodia palowna, Staud. Iris, ii. p. 131 (1889).

Amblypodia amisena, Druce (nec Hew.), P. Z. S. 1873, p. 354.

Kina Balu (*Everett*); Borneo (*Low*).

I have compared these specimens with the type of Dr. Staudinger's *A. palowna* from the island of Palawan, and find that they are identical. *A. palowna* can be distinguished from *A. amisena*, Hew., by the hind wing being notched only, in both sexes—*A. amisena* possessing one tail in the male and two in the female. The underside of the hind wing in *A. amisena* is thickly sprinkled with green scales towards the anal angle, whilst in *A. palowna* these scales are generally entirely absent. I am inclined to think, however, that when a larger series of these butterflies can be examined, these characters will be found to be insufficient to distinguish the two species individually or from Horsfield's *A. vivarna* from Java.

Messrs. Godman and Salvin possess one female, obtained by Mr. Low, on which the purple gloss is entirely absent.

ARHOPALA, Boisd.

All the species here included have, with the exception of the well-known *A. centaurus*, Fab., and *A. apidanus*, Cr., been carefully compared with the actual type specimens, and besides these there are in Messrs. Godman and Salvin's and our own collection about a dozen species which I am unable to determine; but as Mr. G. T. Bethune-Baker is at present engaged on a monograph of the whole genus, I have thought it better to include only those species which I can identify with absolute certainty. Besides these unidentified species, most of which are probably undescribed, there are doubtless many new forms from Kina Balu. Mr. Herbert Druce recorded four species in his paper in P. Z. S. 1873, pp. 353, 354, viz. *A. adatha*, Hew., *A. amphimuta*, Feld., *A. hypomuta*, Hew., and *A. lycænaria*, Hew., which I do not include, as I find that the specimens, which in some cases are not labelled with the names, cannot be referred to these species.

ARHOPALA CENTAURUS.

Papilio centaurus, Fab. Syst. Ent. p. 520 (1775).

Amblypodia nakula, Druce, P. Z. S. 1873, p. 353.

Narathura centaurus, Distant & Pryer, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 269 (1887).

Sandakan (*Pryer*); Labuan (*Low*).

ARHOPALA AGNIS.

Arhopala agnis, Feld. Reise Nov., Lep. ii. p. 228 (1865).

Amblypodia anarte, Druce, P. Z. S. 1873, p. 353.

Labuan (*Low*).

There are two males in Messrs. Godman and Salvin's collection which are identical with Felder's type; also a female which was referred to *A. anarte* by Mr. Herbert Druce.

ARHOPALA AMPHEA.

Arhopala amphea, Feld. Reise Novara, Lep. ii. p. 234, pl. xxix. fig. 19 (1865).

Amblypolia abseus, Druce, P. Z. S. 1873, p. 353.

Sandakan (*Pryer*); Labuan (*Low*).

Bornean specimens agree well with Philippine Island specimens, and if *A. amphea* is considered distinct must stand under that name.

ARHOPALA ATOSIA ?

Amblypodia atosia, Hew. Ill. Diurn. Lep., *Lyc.* p. 9, pl. ii. figs. 8, 9 (1863).

Amblypodia atosia, Druce, P. Z. S. 1873, p. 353.

Labuan (*Low*); Borneo (*Mus. Druce*, ex Rev. R. Murray's collection).

All the Bornean specimens before me are identical with Hewitson's type on both surfaces, but are without the tails, so that I place them under this name with considerable doubt. Mr. de Nicéville's figure of *A. atosia*, Hew. (Butt. Ind. etc. iii. frontispiece, fig. 138, 1890), is very little like Hewitson's type, as on the upperside it appears to be rich purple, while *A. atosia* is lilac-blue, and on the underside is much less distinctly marked than his figure shows.

ARHOPALA AROA.

Amblypodia aroa, Hew. Ill. Diurn. Lep., *Lyc.* p. 13, pl. ii. fig. 13 (1863).

Trusan (*Everett*).

A single male in Messrs. Godman and Salvin's collection, which differs only from Hewitson's type from Sumatra by the bands on the underside being slightly wider, and by the metallic patch near the anal angle being composed of blue in place of green scales.

ARHOPALA PRYERI.

Narathura pryeri, Butl. P. Z. S. 1892, p. 121.

Sandakan (*Pryer*); Sarawak (*Everett*).

Mr. Bethune-Baker will probably tell us to which species this is most nearly allied if it should prove to be a distinct one. It is certainly not closely allied to *A. amphimuta*, Feld., as stated by Dr. Butler, as that species belongs to the tailless group and *N. pryeri* to the tailed, as an examination of the type proves.

ARHOPALA ALLATA.

Amblypodia allata, Stgr. Iris, ii. p. 125, pl. ii. fig. 1, ♀ (1889).

Labuan (*Low*).

Messrs. Godman and Salvin possess a male which differs only from Dr. Staudinger's type, ♂, by the dark brown borders on the upperside being rather narrower.

ARHOPALA ACHELOUS.

Amblypodia achelous, Hew. Cat. Lyc. B. M. p. 7, pl. v. figs. 47, 48 (1862); Druce, P. Z. S. 1873, p. 354.

Labuan (*Low*).

ARHOPALA ANUNDA.

Amblypodia anunda, Hew. Ill. Diurn. Lep. p. 14 *a*, pl. 111 *a*, fig. 32 (1869).

Amblypodia anuda, Druce, P. Z. S. 1873, p. 354.

Labuan (*Low*).

ARHOPALA ELOPURA.

Arhopala elopura, H. H. Druce, Ent. Mo. Mag. ser. 2, vol. v. p. 9 (1894).

Kina Balu (*Waterstr.*); Elopura (*Pryer*). Types Mus. Druce.

Taken by Mr. Pryer in March. Messrs. Godman and Salvin's collection also contains a male.

ARHOPALA APIDANUS.

Papilio apidanus, Cr. Pap. Ex. vol. ii. pl. cxxxvii. figs. F, G (1777).

Amblypodia aphidanus, Druce, P. Z. S. 1873.

Labuan (*Low*); Lawas (*Everett*).

ARHOPALA OLINDA.

Amblypodia olinda, Druce, P. Z. S. 1873, p. 354, pl. xxxiii. fig. 5, ♀.

Amblypodia buxtoni, Hew. Ill. Diurn. Lep., *Lyc.* Supp. p. 22, pl. viii. figs. 68, 69, ♀ (1878).

Narathura buxtoni, Distant & Pryer, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 269 (1887).

Sandakan (*Pryer*); Labuan (*Low*).

On comparing the type (a female) of *A. olinda* with that of *A. buxtoni*, I find that they cannot be separated, and as Hewitson's species was described some five years later than Mr. Herbert Druce's, *A. olinda* is the name by which the insect should be known. The figure given in the P. Z. S. is not a good one, as it shows an equally broad brown marginal border to both wings; this, however, is not so, as in the fore wing the apex is rather broadly brown and in the hind wing the blue area extends nearly to the outer margin. The type of *A. olinda* is now in Messrs. Godman and Salvin's collection.

ARHOPALA CÆCA.

Amblypodia cæca, Hew. Ill. Diurn. Lep., *Lyc.* p. 14, pl. iv. fig. 28 (1863).

Sarawak (*Hew.*).

This species is known to me only by the type in the Hewitson collection.

ARHOPALA AUREA.

Amblypodia aurea, Hew. Cat. Lyc. B. M. p. 8, pl. viii. figs. 87, 88 (1862); Druce, P. Z. S. 1873, p. 353.

Sarawak (*Hew.*); Labuan (*Low*).

ARHOPALA FARQUHARI.

Narathura farquhari, Distant, Rhop. Malay. p. 264, pl. xxiii. fig. 3, ♂ (1885).

Arhopala farquhari, de Nicév. Butt. Ind. etc. iii. p. 264 (1890).

S.E. Borneo.

I include this species here on the authority of Mr. Doherty, not having seen a specimen from Borneo. Messrs. Godman and Salvin possess examples from Malacca, Sumatra, and the Philippine Is.

ARHOPALA HORSFIELDI.

Amblypodia horsfieldi, Pagenstr. Beit. Lep. Faun. Malay. Arch. vi. p. 15 (1890).

Arhopala basiviridis, de Nicév. J. B. N. H. Soc. 1891, p. 373, pl. G. fig. 22, ♂.

Borneo.

Mr. de Nicéville records this insect from Borneo, whence it was also obtained by Mr. Doherty. Dr. Pagenstecher describes it from Eastern Java.

ARHOPALA ANNIELLA.

Amplypodia anniella, Hew. Cat. Lyc. B. M. p. 10, pl. viii. figs. 83, 84 (1862); Druce, P. Z. S. 1873, p. 353.

Kina Balu (*Waterstr.*); Labuan (*Low*).

Bornean specimens agree well with Hewitson's type from Singapore.

ARHOPALA AGESIAS.

Amblypodia agesias, Hew. Cat. Lyc. B. M. p. 11, pl. vi. figs. 55, 56, ♀ (1862).

Sandakan (*Pryer*).

Several specimens agreeing well with the type.

Var. KINABALA, nov.

Differs from the type by being generally larger and with the spots on the underside larger and darker and with an additional spot on the costa of the fore wing.

Kina Balu (*Waterstr.*); Labuan (*Low*).

This may prove to be a distinct species, but for the present I do not think it advisable to treat it as such.

ARHOPALA SIMILIS, sp. n.

Amplypodia agesias, var. *a*, Hew.

♂ ♀. Allied to *A. agesias*, Hew. Upperside much the same. Underside differs by the fore wing being entirely without the discal band of spots which is placed beyond the end of the cell.

Sandakan (*Pryer*). Mus. G. & S. and Druce.

Mr. de Nicéville has recorded this species from Selangor in the Malay Peninsula. It is probably quite distinct from *A. agesias* and has been received in about equal numbers. Hewitson describes *A. agesias* as possessing four spots in the discal band of the fore wing, but counting from the commencement on the costa there are seven or eight, the lowest sometimes being obsolete.

ARHOPALA MYRTALE.

Amblypodia myrtale, Staud. Iris, i. p. 126, pl. i. fig. 16, ♂ (1889).

Sandakan and Elopura (*Pryer*); Labuan (*Low*).

I have before me several specimens which agree well with Dr. Staudinger's type (and figure) from Palawan.

ARHOPALA AMPHIMUTA.

Amblypodia amphimuta, Feld. Wien. ent. Monat. vol. iv. p. 396 (1860).

Narathura amphimuta, Distant & Pryer, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 269 (1887).

Sandakan (*Pryer*).

Included here on the authority of Messrs. Distant and Pryer, as I have not seen a Bornean specimen which agrees exactly with Felder's type.

ARHOPALA ANTIMUTA.

Arhopala antimuta, Feld. Reise Nov., Lep. vol. ii. p. 233 (1865).
Arhopala davisoni, de Nicév. Butt. Ind. etc. iii. p. 280, frontispiece, fig. 135, ♂ (1890).

Sandakan and Elopura (*Pryer*); Labuan (*Low*).

I have been able to examine the type of *A. antimuta* in the Felder collection, and find that *A. davisoni* is identical with it. It is entirely without the large round patch of scales described by Mr. de Nicéville (Butt. Ind. etc. iii. p. 277), but not by Felder, as belonging to it. Mr. de Nicéville appears to have confounded the species which I have doubtfully referred to *A. atosia*, Hew., with *A. antimuta*, but an examination of Felder's type proves that this is incorrect. The blue colour of the type and only specimen in the Felder collection is quite dark, much as in *A. aroa*, but darker, whilst the specimens he probably refers to are quite a different colour. Mr. H. J. Elwes records it from Borneo (P. Z. S. 1892, p. 633)[1].

ARHOPALA ALACONIA.

Amblypodia alaconia, Hew. Ill. Diurn. Lep., *Lyc.* p. 14, pl. iii c. figs. 52, 53 (1869); Druce, P. Z. S. 1873, p. 353.

Labuan (*Low*).

Below will be found described what I believe to be a new species of the genus *Mahathala*, Moore[2].

ARHOPALA EPIMUTA.

Amblypodia epimuta, Moore, Cat. Lep. E. I. C. p. 42 (1857).

Borneo (*Low*).

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[1] Messrs. Godman and Salvin's collection contains a single specimen of *A. inornata*, Feld., from the Philippine Is., which I have compared with Felder's type. The figure is a fairly good one, and anyone possessing the species should have no difficulty in recognizing it on account of its unusual shape. The hind wing below is entirely without any metallic scales at the anal angle. It is apparently a rare species, as the specimen here mentioned is recorded for the first time since it was described.

[2] MAHATHALA GONE, sp. n.

Allied to *M. ameria*, Hew. Upperside dark purple-blue with much broader black margins; cilia, tails, and anal fold of hind wing buff-colour. Underside—fore wing dull greyish brown with pale bars and markings arranged as in *M. ameria*, but with the ultra-median band wider, straighter, and not angled on the costa as in that species: hind wing uniform dull yellowish stone-colour, sprinkled with minute black dots, generally largest on the nervules; two dull black irregular spots in line near the base just below the median nervure, the largest at the origin of first median nervule. A few patches of pale reddish scales, thickest near the base. Head, thorax, and abdomen black above, yellowish beneath. Antennæ black.

Expanse $1\frac{7}{10}$ inch.

Hab. Mongolia. Type Mus. G. & S.

The type specimen, which was formerly in Mr. Druce's collection, is unique, and differs so much from all specimens I have seen of *M. ameria* that I feel sure it is another species. I cannot determine to which sex the specimen described belongs.

Mr. Moore's type is now in the British Museum Collection. Mr. Bethune-Baker will doubtless decide whether the insects from India afterwards described by Hewitson in the British Museum Catalogue as *A. epimuta* are identical with the type.

CURETIS, Hübn.

Mr. de Nicéville has expressed the opinion that there are but two species of this genus occurring within Indian limits (Butt. Ind. etc. vol. iii. p. 285), and later (p. 291) that *C. æsopus* is a distinct connecting link between these two. In arranging the Bornean species I have found the same difficulty in pairing the females as he mentions with regard to those from India. So far as I can ascertain, the ochreous-coloured female is the only form that is found in Borneo, as I have not come across a single white one.

CURETIS TAGALICA.

Anops tagalica, Feld. Reise Novara, Lep. ii. p. 221, pl. xxviii. figs. 19, 20 (1865).

Curetis tagalica, Druce, P. Z. S. 1873, p. 353.

Labuan (*Low*).

C. tagalica is scarcely distinguishable from *C. phædrus*, Fab., on the upperside, but on the underside Bornean specimens are usually very strongly suffused with blackish brown.

CURETIS NESOPHILA.

Phædra nesophila, Feld. Wien. ent. Mon. vi. p. 289 (1862).

Curetis barsine, Druce, P. Z. S. 1873, p. 353 (nec Feld.).

Kina Balu (*Waterstr.*); Sarawak (*Platen*); Labuan (*Low*, *Waterstr.*, and *Wahnes*).

In *C. nesophila* the cupreous red does not extend above the subcostal nervure in the fore wing except just at the base. Mr. Herbert Druce referred these specimens to *C. barsine*, Feld., from Amboina, which has a female with white spots on the discs; but as there appears to be no evidence of any white females occurring in Borneo, I think it better to place them under *P. nesophila.*

CURETIS MINIMA.

Curetis minima, Distant & Pryer, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 265 (1887).

Sandakan (*Pryer*).

I have not seen this species, which is described as being near to *C. insularis*, Horsf., from Java.

CURETIS ÆSOPUS.

Papilio æsopus, Fab. Sp. Ins. vol. ii. p. 125 (1781).

Kina Balu (*Waterstr.*); Labuan (*Waterstr.* and *Wahnes*); S.E. Borneo, near Banjarmasin (*Wahnes*).

The specimens before me vary as to the extent of cupreous red above the subcostal nervure in the hind wing. In some examples the outer half only of the costal margin is narrowly brown, in others the whole margin is broadly brown from the base. Between these two forms are all intermediates.

CURETIS MALAYICA.

Amops malayica, Feld. Reise Novara, Lep. ii. p. 221, pl. xxviii. fig. 18 (1865).

Kina Balu (*Waterstr.*); S.E. Borneo, near Banjarmasin (*Wahnes*).

A female from Kina Balu has the costal margin of the hind wing very pale, almost white.

ILERDA, Doubl.

ILERDA KIANA.

Sithon kiana, Grose Smith, Ann. & Mag. Nat. Hist. ser. 6. vol. iii. p. 317 (1889); Whitehead, Kina Balu, p. ~~118~~, pl. xx. figs. 7, 8 (1893).

Kina Balu (*Everett, Whitehead, Waterstradt*).

The apparent likeness of the underside of this Butterfly to species of the genus *Ilerda* led me to carefully examine its neuration, and on bleaching specimens of both sexes I find that the neuration is exactly the same as in *I. epicles*, Godt. It agrees also in the form of the antennæ and in the absence of any secondary sexual characters; the only difference that I can detect is that the terminal joint of the palpus is slightly longer than in *I. epicles*. It has been received in some numbers from Kina Balu, and is remarkably different from any other species of the genus. Both sexes are much alike, the female having a rather less extensive and greyer blue anal patch with larger black spots. Mr. Grose Smith has kindly shown me his type.

DACALANA, Moore.

DACALANA VIDURA.

Amblypodia vidura, Horsf. Cat. Lep. E. I. C. p. 113 (1829)[1].

Iolaus vidura, Druce, P. Z. S. 1873, p. 351.

Dacalana vidura, Distant & Pryer, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 268 (1887).

Sandakan; Elopura (*Pryer*); Trusan (*Everett*); Labuan (*Low*); S.E. Borneo, near Banjarmasin (*Wahnes*).

The white band crossing the wings on the underside varies somewhat in width in Bornean specimens as it does in Javan.

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[1] Messrs. Godman and Salvin possess a male *Dacalana burmana*, Moore, collected in Burmah by Hume, which agrees in venation exactly with *D. vidura*. Indeed it is very doubtful if *D. burmana* can claim specific rank from that species; the upperside is certainly a darker blue colour, but the characters given for the underside are valueless. Mr. H. J. Elwes gives it as a synonym in his paper in the P. Z. S. 1892, on Butterflies collected by Mr. Doherty in the Naga and Karen hills and Perak.

ARRHENOTHRIX, de Nicév.

It is with much pleasure that I am able to add another species to this interesting genus; I have carefully examined the specimen and find that it agrees exactly in venation with *A. penicilligera*, de Nicév.,—thus proving that *Dacalana* and *Arrhenothrix* are found flying together.

ARRHENOTHRIX LOWII, sp. n. (Plate XXXIII. fig. 2 ♂.)

♂. Upperside much like *A. penicilligera*, but of a much duller and more purple shade of blue; the apex and outer margin of fore wing considerably less broadly black. The outer margins of both wings, especially that of the hind wing, much more convex than in *A. penicilligera*. The whitish tuft of hairs covering the brown patch on the fore wing as in *A. penicilligera*. Underside differs from that species in the more russet-brown colour and by the complete absence of the conspicuous white band which crosses both wings. The lobe also is smaller and the tails shorter and more slender, especially that one on the submedian nervure, which is scarcely half the length of the corresponding tail on *A. penicilligera*.

Expanse 1½ inch.

Labuan (*Low*).

The type of this species, and the only specimen known to me, is in Messrs. Godman and Salvin's collection. A glance at the underside will at once distinguish this from its congener.

PRATAPA, Moore.

PRATAPA LUCIDUS, sp. n. (Plate XXXIII. fig. 3 ♂.)

Iolaus cippus, Druce, P. Z. S. 1873, p. 351.

♂. Closely allied to *P. cippus*, Fab. Differs on the underside by the entire absence of the linear band, excepting over the orange patch at the anal angle of the hind wing, where it is present but very narrow. The black spots are smaller, and the orange patch is darker and not divided as in *P. cippus*.

Expanse as *P. cippus*.

Labuan (*Low* and *Waterstr.*). Type Mus. G. & S.

The specimens before me show no variation. Messrs. Godman and Salvin's collection also contains this species from Sumatra.

PRATAPA SANNIO, sp. n. (Plate XXXIII. fig. 15 ♂.)

♂. Allied to *P. anysis*, Hew. Upperside much the same, but with the shining surface on the hind wing extending further down towards the apex. Underside differs from *P. anysis* by the band which crosses both wings being narrow and more sordid white, by the shining surface along the inner margin of the fore wing being blacker, and by the broken black line in the hind wing being more curved outwardly towards the apex and more inclined to be semicircular over the orange patch, which is rather less extensive. The spot on the lobe, which in *P. anysis* is completely black, is faintly crowned with orange. The shape of the hind wing is entirely different, it being less produced at the costal and anal extremities and the outer margin much more rounded. Tuft of hairs on inner margin of fore wing dark brown.

Expanse $1\frac{3}{5}$ inch.

Sandakan (*Pryer*). Type Mus. G. & S.

Allied to *P. anysis*, Hew., and *P. cremera*, de Nicév., but has a much narrower band below, besides other differences pointed out in the description[1].

Pratapa devana, sp. n. (Plate XXXIII. fig. 4 ♂, 5 ♀.)

Iolaus devana, Staud. MS.

Allied to *P. deva*, Moore.

♂. Upperside very pale shining blue, palest on the disc of the fore wing; apical half and outer margin of fore wing and costal margin and apex of hind wing dark greyish brown; an outer-marginal row of more or less distinct dark brown spots on the hind wing, and a black anteciliary line; the shining patch is large and prominent, spreading all over the cell, and centred by a deep black patch of differently placed scales resting on the subcostal nervure; an orange spot in the lobe; anal fold greyish white. Underside differs from *P. deva* by being of a more pinkish tinge, with the linear band which crosses both wings more distinct, less broken, and placed closer to the outer margins; the orange patch surrounding the upper black spot on the margin much more extensive. The tuft of hairs on inner margin of fore wing jet-black. Abdomen and thorax blue above, whitish below.

♀. Upperside pale lavender-blue, paler on the discs of the fore wing, more extensive than in the male; apex and outer margin of fore wing and apex of hind wing greyish brown; a distinct black streak almost closing the cell of the fore wing, and an outer-marginal row of black spots on the hind wing. Underside as male, with a faint mark closing the cell of the fore wing, caused by the black mark on the upperside.

Expanse, ♂ $1\frac{3}{5}$, ♀ $1\frac{1}{2}$ inch.

Kina Balu and Labuan (*Waterstr.*). Types Mus. Staud.

P. devana is by far the palest coloured species in the genus, being paler than the female *P. cotys*, Hew. It is a very distinct species, and the black mark closing the cell of the fore wing in the female is quite unusual.

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[1] Mr. H. J. Elwes has lately remarked (P. Z. S. 1892, p. 637) that the tuft of hairs on the margin below is absent in *C. cotys*, whilst Mr. de Nicéville (Butt. Ind. etc. vol. iii. p. 343) states that the tuft of hairs in *C. anysis* is black instead of dark brown in *C. cotys*. Specimens of *C. cotys* that I have examined from Darjeeling certainly have the usual tuft, while in a specimen of *C. anysis* from the Philippines in Messrs. Godman and Salvin's collection the tuft is dark brown as in *C. cotys*.

PRATAPA CALCULIS, sp. n. (Plate XXXIII. figs. 6 ♂, 7 ♀.)

♂. Upperside brilliant deep blue, colour of *P. deva*, Moore. Fore wing—apex from beyond the cell black, gradually narrowing towards outer angle; a short black line partially closing the cell from the subcostal nervule. Hind wing—costal margin and apex rather narrowly black; the brown shining patch more extensive than in *P. deva*, reaching below the median nervure, with its outer edge straight and clearly defined, and with the darker central patch almost obsolete and placed above the subcostal nervure; anal fold greyish brown; a black anteciliary line from apex to anal angle; cilia black, whitish near the tails, which are black bordered and tipped with white; lobe orange, with a few metallic scales. Underside much like that of *Tajuria isæus*, Hew., but the ground-colour darker and the common linear band placed closer to the outer margins; a broad orange streak on the costa of fore wing close to the base. The black spots and orange patch at anal angle of hind wing are just as in *T. isæus*; tuft of hairs on inner margin cream-colour.

♀. Upperside pale lavender-blue with paler brown margins; the nervules dusted with brownish. Underside as male, but orange streak on costa of fore wing less conspicuous.

Expanse, ♂ ♀, $1\frac{2}{5}$ inch.

Kina Balu (*Waterstr.*).

This is a very distinct species, not closely allied to any with which I am acquainted. The types are in Dr. Staudinger's collection.

APHNÆUS, Hübn.

APHNÆUS SYAMA.

Amblypodia syama, Horsf. Cat. Lep. E. I. C. p. 107 (1829).

The ground-colour of the underside of all the Bornean specimens I have examined is darker than the typical Javan form. Specimens having the bands red occur, as also those with the bands black.

Labuan (*Low* and *Waterstr.*).

Ab. FRIGIDUS.

Aphnæus frigidus, Druce, P. Z. S. 1873, p. 350, pl. xxxii. fig. 10.

I feel certain that the species described as above cannot hold good, but that it is simply an aberration of the well-known *A. syama*, On the underside of the left fore wing the 3rd band (counting from the base) is represented by a spot on the costa, whilst on the right fore wing the 3rd and 4th bands are both represented in a like manner. Messrs. Godman and Salvin possess a specimen in which the 3rd and 4th bands have entirely disappeared; also another, in which the 3rd band is well developed and has attached to it the lower portion of the 4th band, the upper part of which is wanting. The hind wing of typical *A. frigidus* also appears quite different from *A. syama*, the 3rd band being replaced by a large spot on the costa; but one of the specimens referred to above has this spot much smaller, whilst the other has the spot and below it the band which is bent inwards just under the spot and becomes partially amalgamated with the 2nd band.

It is curious that *A. syama* should show such great variation in Borneo. In Continental India it varies much in the ground-colour, but I have seen no specimens at all approaching these, neither does Mr. de Nicéville mention any. Mr. Herbert Druce did not give *A. syama* in his list; probably they were received after it was published.

APHNÆUS LOHITA.

Amblypodia lohita, Horsf. Cat. Lep. E. I. C. p. 106 (1829).

Kina Balu and Labuan (*Waterstr.*).

A. lohita does not appear to have been obtained by Low, but Dr. Staudinger has received it in considerable numbers—one large female from Kina Balu measuring $1\frac{9}{10}$ inch.

APHNÆUS VIXINGA.

Aphnæus vixinga, Hew. Ent. Mo. Mag. xii. p. 39 (1875).

Borneo (*Low*).

This is a large and distinct species known to me only by the type. The ground-colour of the underside is very dark, and the silver spots are quite different from the other two Bornean representatives of the genus.

TAJURIA, Moore.

All the species here included in this genus have three subcostal nervules in the fore wing and are without any secondary sexual characters.

TAJURIA JALINDRA.

Amblypodia jalindra, Horsf. Cat. Lep. E. I. C. p. 109 (1829).

Sithon jalindra, Druce, P. Z. S. 1873, p. 352.

Labuan (*Low* and *Waterstr.*).

TAJURIA MACULATUS.

Iolaus maculatus, Hew. Ill. Diurn. Lep., *Lyc.* p. 47, pl. xxi. figs. 29, 30 (1865).

Kina Balu (*Waterstr.*).

T. maculatus is, I believe, recorded here for the first time out of India, where it occurs in Sikkim and Assam.

TAJURIA LONGINUS.

Hesperia longinus, Fab. Ent. Syst. Suppl. vol. v. p. 430 (1798).

Hab. Sarawak (*Mus. Druce*).

We possess a single male specimen, which is my only authority for including this well-known species.

TAJURIA DOMINUS, sp. n. (Plate XXXIII. fig. 12 ♂.)

♂. Upperside brilliant shining cerulean blue, much like *P. cleobis*, Godt., but more opalescent; fore wing with the apex broadly black and with a quadrate black "sexual mark" occupying rather more than the outer half of the cell; hind wing—costal margin greyish, darker towards the apex, which is black. Underside differs from *P. cleobis* by the ground-colour being darker, the linear band being placed closer in, the black spots at the anal angle being much larger, and the yellow being much more extensive and confluent. The patch between the spots is dusted with metallic scales.

Expanse $1\frac{2}{5}$ inch.

Kina Balu (*Waterstr.*).

T. dominus is allied to *T. melastigma*[1], de Nicév., but in that species the "sexual mark" is placed beyond the cell. It is also much like *T. cleoboides*[2], Elwes, which is described as possessing only two subcostal nervules to the fore wing, whilst *T. dominus* has three. Messrs. Godman and Salvin possess a specimen, which I believe to be referable to *T. dominus*, which differs only from the type on the underside by the black spots being smaller and the yellow less extensive: it is labelled "Burmah."

TAJURIA MANTRA.

Myrina mantra, Feld. Reise Novara, Lep. vol. ii. p. 238, pl. xxx. fig. 14 (1865).

Iolaus mantra, Druce, P. Z. S. 1873, p. 351.

Iolaus cyrinus, Staud. MS.

Kina Balu (*Waterstr.*); Labuan (*Low*).

T. mantra is a common insect in Borneo.

TAJURIA CYRUS, sp. n. (Plate XXXIII. figs. 10 ♂, 11 ♀.)

Iolaus cyrus, Staud. MS.

♂. Allied to *T. mantra*, Felder, but larger, and the outer margin of fore wing convex. Upperside blue, slightly paler, without the opalescence, and more extensive in both wings; a black spot in the lobe crowned with orange. Underside differs from that of *T. mantra* ♂ by the ground being much paler, by the linear band of the fore wing being narrower and indistinct, by the inner margin of the fore wing being broadly white for nearly its whole length, and by the orange patches at the anal angle of the hind wing being of a deeper shade.

♀. Differs from the male by the blue being of a slightly paler shade and considerably more extensive in the fore wing; the black spot in the lobe and the orange crowning it are both larger. Underside as male, but inner margin of fore wing not so distinctly white and the linear band of fore wing more prominent.

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[1] *T. melastigma*, de Nicév,. P. Z. S. 1887, pl. xl. fig. 1.

[2] *T. cleoboides*, Elwes, P. Z. S. 1892, p. 637, pl. xliv. figs. 4, 5.

T. melastigma is described as having the "sexual mark" shining black, but in the figure it is shown as pale brown, much the colour of the underside. *T. cleoboides* is described as having "a large round velvet patch free from blue scales in the cell of the fore wing"—presumably a black patch; but this does not appear in the figure of the insect.

Expanse, ♂ ♀, 2 inches.

Kina Balu (*Waterstr.*).

This is a fine and, I believe, quite distinct species, which should be easily recognized.

TAJURIA TUSSIS, sp. n. (Plate XXXIII. figs. 8 ♂, 9 ♀.)

♂. Pale blue, much the colour of *T. isœus*, Hew. Differing from that species by the apical half of the fore wing being black, the black apex extending from just beyond the cell to the outer angle. The underside differs from *T. isœus* by the common linear band being placed nearer to the margins, by having a pale orange streak at the base of the costa on the fore wing, and by the orange at the anal angle being darker.

♀. Upperside dull violaceous blue, more extensive in the fore wing than in male; hind wing with the nervules brown and with a marginal row of ill-defined brown spots. Underside as male, but the costal streak but slightly ochreous and barely discernible, whilst the linear bands appear to be further in.

Expanse, ♂ $1\frac{3}{40}$ inch, ♀ $1\frac{3}{5}$ inch.

Labuan (*Waterstr.*).

The types of this species are the only specimens I have seen and belong to Dr. Staudinger. I do not feel quite certain that the female here described belongs to the male, as the linear band is placed somewhat further in—it is not, however, anything like so far in as in *T. isœus*.

TAJURIA ISÆUS.

Iolaus isœus, Hew. Ill. Diurn. Lep., *Lyc.* p. 44, pl. xix. figs. 13, 14 (1865).

Sarawak (*Hew.*).

Hewitson is my only authority for including this species.

Mr. H. J. Elwes has lately pointed out[1] that *T. relata*, Distant, is conspecific with *T. isœus*, and after an examination of the type ♂ kindly sent me by Dr. Staudinger, I am able to confirm this statement—it is identical with Hewitson's species.

TAJURIA CATO, sp. n. (Plate XXXIII. figs. 13 ♂, 14 ♀.)

♂. Upperside bright blue, brighter and darker than in *T. mantra* and somewhat differently placed—in the fore wing there being less in the cell and more in the first median interspace, and in the hind wing more extensive; apex and outer margin black, with a large inconspicuous black patch of differently placed scales occupying more than the upper half of the cell in the fore wing. Anal fold dark greyish; lobe with a black spot dusted with a few metallic scales, but no orange. Tails black, tipped with white, the lower with bluish cilia. Underside rich dark reddish brown, with a common, straight, dark red linear band outwardly edged with white, angled towards anal margin of hind wing; inner margin of fore wing paler greyish brown. The cells of both wings are closed by faint marks caused apparently by appressions. Hind wing—a large black spot crowned by metallic-blue scales occupying the whole of the lobe, above that from the submedian nervure to the third median nervule a large greyish patch thickly dusted with black scales, and resting on this between the first and second median nervules a rather small black spot crowned with dark red. Thorax and abdomen bluish above, dark buff below. Head brown; antennæ black, ringed with white. All the legs black, spotted with pale buff. Cilia on both surfaces cupreous brown, except at anal angle, where it is greyish.

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[1] P. Z. S. 1892, p. 637.

♀. Upperside paler and more lavender-blue; the blue more extensive in the fore wing and reaching beyond the end of the cell, at which there is a white spot; the black spot in the lobe is faintly crowned with orange scales. Underside as male but paler.

Expanse, ♂ ♀, 1½ inch.

Kina Balu (*Waterstr.*).

This is a beautiful species, not closely allied to any other. The distinctly spotted legs are quite unusual in the *mantra* group. The types belong to Dr. Staudinger's collection.

TAJURIA TRAVANA.

Myrina travana, Hew. Ill. Diurn. Lep., *Lyc.* p. 38, pl. xvii. fig. 59, 60 (1865).

Sithon travana, Druce, P. Z. S. 1873, p. 352.

Kina Balu (*Waterstr.*); Sandakan (*Pryer*); Labuan (*Low*).

Mr. de Nicéville (Butt. India, iii. p. 38, 1890) is of opinion that this species should be treated as a local race only of *T. jangala*, Horsf.

Two females of *T. jangala*, Horsf., in Messrs. Godman and Salvin's collection are entirely brown on the upperside.

TAJURIA DONATANA, de Nicév.

Tajuria donatana, de Nicév. J. A. S. B. vol. lvii. p. 287, pl. xiv. fig. 5 (1888); Butt. Ind. etc. iii. p. 382, pl. xxv. fig. 154, ♂ (1890).

Labuan (*Low*).

Messrs. Godman and Salvin's collection contains a single male specimen of this species, which differs only from the figure (no. 154, Butt. India, iii.) by the black spot in first median interspace on the underside of hind wing being somewhat larger.

PURLISA, Distant.

PURLISA GIGANTEUS.

Iolaus (*Purlisa*) *giganteus*, Distant, Ent. Mo. Mag. vol. xvii. p. 245 (1881).

Purlisa gigantea, Distant, Rhop. Malay. p. 250, pl. xxi. fig. 28 (1885).

Sarawak (*Mus. Druce*).

We possess a fine female specimen which agrees well with Mr. Distant's figure and expands no less than 2½ inches, whilst the tail on the submedian nervure measures $\frac{3}{5}$ inch and is much broader than in any of the species of *Tajuria*, the nervure being distinctly visible along it almost to the tip; so that it is more probably allied to *Cheritra*, Moore, where it was placed by Mr. Distant, than to *Tajuria* as suggested by Mr. de Nicéville (Butt. India, iii. pp. 385, 386, 1890).

It must be a rare insect wherever it occurs, as being so conspicuous it would have been more frequently captured.

The only other recorded locality for it is Penang.

SUASA, de Nicév.

SUASA LIRIS.

Sithon liris, Staud. Iris, ii. p. 110, pl. i. fig. 10, ♂ (1889).

Kina Balu (*Waterstr.*).

The Bornean specimens have the apex and outer margin of the fore wing below a much duller shade of yellow than the type from Palawan, otherwise they agree well. The female, like that of *S. lisides*, Hew., is without the black subbasal spot on the hind wing.

THAMALA, Moore.

THAMALA MARCIANA.

Myrina marciana, Hew. Ill. Diurn. Lep., *Lyc.* p. 34, pl. xvi. fig. 44 ♂, pl. xii. figs. 12, 13 ♀ (1863).

Thamala marciana, de Nicév. Butt. Ind. etc. vol. iii. p. 388 (1890).

Sarawak (*Hew.*); S.E. Borneo (*Doherty, vide de Nicév.*).

HYPOLYCÆNA, Feld.

HYPOLYCÆNA ERYLUS.

Polyommatus erylus, Godt. Enc. Méth. vol. ix. p. 633 (1823).

Hypolycæna erylus, Druce, P. Z. S. 1873, p. 351.

Trusan, N. Borneo (*Everett*); Labuan (*Low* and *Waterstr.*).

Bornean specimens of this species usually have the apices and outer margins of the wings below thickly dusted with russet-brown.

HYPOLYCÆNA THECLOIDES.

Myrina thecloides, Feld. Wien. ent. Monatsch. vol. iv. p. 395 (1860).

Hypolycæna thecloides, Druce, P. Z. S. 1873, p. 351.

Labuan (*Low* and *Waterstr.*).

Bornean specimens before me differ from Burmese by having slightly more yellow on the upperside of hind wing.

HYPOLYCÆNA SKAPANE, sp. n. (Plate XXXIII. figs. 16 ♂, 17 ♀.)

♂. Upperside dull brownish purple; apex of fore wing and costal margin of hind wing rather broadly brown; outer margin of fore wing narrowly brown. Anal fold greyish brown; a black spot on the lobe outwardly bordered with white. Cilia brown except in anal region, where it is white. Tails black, bordered with white. Underside pearly grey, coloured and marked much like *Z. etolus*, Fab., but without the black spot on the costal margin of the hind wing and with the band of the fore wing straighter, narrower, and more distinctly outer-edged with whitish, whilst on the hind wing the band, which in *Z. etolus* becomes linear and black towards the anal margin, is in this species yellow, of about equal width, and narrowly edged on both sides with black. The large black spot on the outer margin of hind wing between the first and second median nervules is bordered with orange on its inner and lower edges.

♀. Upperside uniform blackish; anal angular area rather broadly white, containing a series of four marginal black spots, alternately large and small, the first, in the lobe, being large. Underside as male, but brighter.

A tuft of the cilia in both sexes is considerably elongated at the extreme anal angle, thus giving the insect the appearance of having a third, but very short tail.

Expanse, ♂ $1\frac{1}{5}$, ♀ $1\frac{1}{10}$ inch.

Kina Balu (*Waterstr.*). Types Mus. Staud.

I have compared this species to *Z. etolus* on the underside, but it is perhaps more like *H. thecloides* on that surface, but very different above. It is much smaller than the average *H. erylus*. It is also not unlike the *Chliaria merguia* as figured by Mr. Doherty[1], but on the upperside the blue is much darker and not distinctly defined in the fore wing, and on the underside the band of the fore wing is straighter and the black spot between the median nervules is larger and also edged with orange; this is not shown in Mr. Doherty's figure, although he describes it as being present.

HYPOLYCÆNA PHEMIS, sp. n. (Plate XXXIII. fig. 18 ♂.)

♂. Upperside rather dull slaty blue, but in some lights rich light purple-blue, much the colour of the darker blue on *Chliaria kina*, Hew., darkest in the fore wing. Costal apex and outer margin of fore wing and costal margin of hind wing blackish. Anal fold greyish white. A black spot in the lobe and two indistinctly defined marginal spots above it. Tails black with white borders; cilia as usual. Underside differs from *Z. etolus*, Fabr., only by the yellow apices being less extensive and much browner, by the black spot on the costa of the hind wing being replaced by a minute yellowish spot, by the double markings closing the cells being very inconspicuous, and by the band on the hind wing continuing wide where it is angled and broken towards the anal margin, not becoming linear as in *Z. etolus.* There are no metallic scales at the anal angle.

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[1] *Chliaria merguia*, Doherty, J. A. S. B. lviii. p. 427, pl. xxiii. fig. 2 (1889).

♀. Upperside much like that sex of *H. skapane*, mihi, with the white area larger. Underside as male. The male has a small blackish, inconspicuous, "sexual mark" on the fore wing, placed on the median nervules at their origin, whilst the hind wings of both sexes appear to be more produced anally than either of the other species of the genus.

Expanse, ♂ ♀, $1\frac{1}{5}$ inch.

Kina Balu (*Waterstr.*). Types Mus. Staud.

The thorax and abdomen in the male, when the insect is held at an angle, appear even more brilliant than the wings. *H. phemis* is not unlike the West-African *H. hatita* [1], Hew., on the upperside, but the tails are shorter.

CHLIARIA, Moore.

CHLIARIA MIMIMA, sp. n. (Plate XXXIV. fig. 1 ♂.)

♂ ♀. Allied to *C. othona*, Hew. Upperside differs from that species by the blue being of a paler and greyer shade and reduced to a patch below the median nervure in the fore wing. The underside differs from that of *C. othona* by the costa, apex, and outer margin of the fore wing being suffused with orange, by the discal bands in both wings being straighter, less broken, and of equal width their whole length. The black spot on costa of the fore wing and also the two on the costa of the hind wing are present but smaller.

Expanse, ♂ 1, ♀ $1\frac{1}{5}$ inch.

Kina Balu and Labuan (*Waterstr.*).

Distinguished at once by the different underside. The types are in Dr. Staudinger's collection. We also possess this species from N.E. Sumatra, but on the upperside the blue extends over the cell in the fore wing.

ZELTUS, de Nicév.

ZELTUS ETOLUS.

Papilio etolus, Fab. Mant. Ins. ii. p. 66 (1787).

Hypolycæna etolus, Druce, P. Z. S. 1873, p. 351.

Kina Balu (*Waterstr.*); Labuan (*Low*).

In all the specimens I have seen the apices of the wings below are much suffused with rich reddish brown. It is a common insect at Labuan.

PSEUDOMYRINA, gen. nov.

Allied to *Tajuria*, Moore. Fore wing more arched; the apex more rounded, and the inner margin distinctly convex. Venation much the same, but the cell of the fore wing distinctly shorter and broader. Hind wing with a large oval glandular patch near the base, partly resting on the subcostal nervure and extending upwards to the costal nervure, and lying over that is a tuft of long hairs, which are attached to the membrane of the wing below the glandular patch and the subcostal nervure.

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[1] *H. hatita*, Hew. Ill. Diurn. Lep., *Lyc.* p. 51, pl. xxiii. figs. 21–24 (1865).

The female possesses the same number of subcostal nervules as the male.

The tail on the submedian nervure is rather long and broad, whilst that on the first median nervule is short and thread-like.

Type, *Myrina martina*, Hew.

This is I believe the first genus described amongst the *Lycænidæ* in which the male possesses both the glandular patch and the tuft of hairs on the hind wing, and these characters serve at once to distinguish it from all others.

Hewitson in describing his *Myrina martina* noted its peculiarities, but no writer has since referred to them. I have compared it with *Tajuria*, but probably it is more nearly allied to *Neocheritra*, Distant, which differs by possessing an additional subcostal nervule in the fore wing (in the male) and a tuft of hairs on fore wing below.

In pattern and coloration *Neocheritra* and *Pseudomyrina* are much alike.

PSEUDOMYRINA MARTINA.

Myrina martina, Hew. Ill. Diurn. Lep., *Lyc.* Suppl. p. 3, t. 2. figs. 70, 71 (1869).

Sithon martina, Druce, P. Z. S. 1873, p. 351.

♀. Upperside brown, with white markings at the anal angle. Much like that sex of *Neocheritra theodora* (see p. 608), but with the tails considerably shorter. Underside as male.

Kina Balu (*Waterstr.*); Labuan (*Low* and *Waterstr.*).

On the underside this species closely resembles *Neocheritra amrita*, Feld., and *N. theodora*, mihi, but can be distinguished by the brown bar over the spots at the anal angle becoming broader and straighter as it reaches the inner margin, which is not so in the species mentioned [1].

VIRGARINA, gen. nov.

Allied to *Pseudomyrina*. With three branches to the subcostal nervure of the fore wing as in that genus, the third, however, being emitted sooner and consequently longer. Upperside of fore wing with a large elongate-oval glandular patch below the median nervure, placed obliquely across the wing and divided down the middle and having much the appearance of a grain of wheat inverted; at the upper (basal) end of this patch is, attached to the membrane of the wing, a tuft of long pale brown hairs which can apparently stand erect, lie flat over the patch, or be so enclosed by the two halves of the patch as to be visible only at the base. The submedian nervure is much affected by the patch and is bent towards the inner margin where it passes it.

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[1] Messrs. Godman and Salvin's collection contains male specimens of *P. hypoleuca*, Hew., from Malang and Lawang—both in Java—which on examination prove to belong to *Pseudomyrina*. They possess tails of about the same length as *P. martina*, but rather slighter; that on the submedian nervure being white, that on the first median nervule black with white tip, and white fringe. Dr. Staudinger has sent specimens of *P. hypoleuca* from Java under the name "*mamerta*," Staud., but I do not know where he has described it. He has also sent me for examination the type female of his *Sithon paluana*, which I find is identical with the female of *C. martina*, Hew.

Type, *Sithon scopula*, Druce.

This remarkable genus is, so far as I can ascertain, monotypic, and with *Thrix*, Doherty[1], presents the peculiarity of having the glandular patch as well as the tuft of hairs on the fore wing on the upperside. The scaly patch is very curious and causes a considerable erection on the underside. It seems possible that the insect has the power of sheathing the long tuft of hairs, at any rate I have before me specimens which show it individually in the three positions described above. I notice also that all around the patch the scales are rubbed away as if from the continued friction caused by the whisking of these hairs. It is a very interesting insect, and when some one is able to observe it in nature we shall doubtless learn more of its peculiarities.

VIRGARINA SCOPULA.

Sithon scopula, Druce, P. Z. S. 1873, p. 353, pl. xxxiii. fig. 2.

♂. Upperside—fore wing rich purplish brown, with all the margins lighter, the outer margin being more broadly so. Hind wing: upper half, including apex, dark brown; lower half light cærulean blue, sprinkled with whitish towards the anal angle. A series of three indistinct whitish spots in the interspaces, two between the median nervules and one between the submedian nervure and the 1st median nervule, and crowning these whitish spots are three indistinct small patches of scattered black scales. Lobe but slightly developed, white, with a marginal black spot on its upper edge. Cilia of fore wing brown; of hind wing brown, down to the edge of the blue, when it becomes pure white and is so continued to the anal angle; tails pure white. Underside yellowish buff-colour, corresponding with the brown of the upperside on both wings; lower half of hind wing white, with a somewhat irregular brown band composed of confluent lunules placed about halfway between the middle of the wing and the margin. A series of four distinct black spots towards the anal angle, situated as follows: the first, and smallest, close to the margin between the median nervure and the second median nervule; the second, large, between the first and second median nervules; the third intermediate in size between these two, placed much farther from the margin and consequently out of line, and in that respect corresponding with the portion of the brown band which is immediately over it; the fourth spot, which is small, is placed on the margin over the lobe and is in line with the first two. There are indications of brownish marks close to the margin between the nervules beyond the spots. There is an anteciliary black line to that part of the hind wing which is white, and beyond a white cilium. The cilia of fore wing and remaining portion of hind wing concolorous with wings.

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[1] *Thrix*, J. A. S. B. vol. lx. pt. 2, p. 35 (1891), described as having four subcostal nervules to fore wing.

♀. Upperside much like that sex of *P. martina*, Hew., but the white anal area of hind wing more extensive, with the black spots more inclined to be separated and the nervules crossing the white area white, not brown as in that species. Underside as male, but the yellow of a much brighter shade and the black markings on hind wing inclined to be larger and more distinct.

Kina Balu (*Waterstr.*); Labuan (*Low* and *Waterstr.*); Sandakan (*Elwes*).

In the figure given of this species (P. Z. S. 1873) the tuft of hairs appears to lie along the median nervure from the base. This is incorrect, as it does not originate near the base but just over the glandular patch. The female can be distinguished from that sex of *P. martina* by the inner black band on hind wing being (as in the male) placed farther from the margin than in that species.

V. scopula varies much in size, one male measuring $1\frac{3}{10}$ inch, whilst another expands $1\frac{7}{10}$ inch.

The female has three subcostal nervules as in the male.

NEOCHERITRA, Distant.

NEOCHERITRA AMRITA.

Myrina amrita, Feld. Wien. ent. Monatsch. vol. iv. p. 395 (1860).

Labuan (*Low* and *Wahnes*); S.E. Borneo, near Banjarmasin (*Wahnes*).

Var. THEODORA.

Neocheritra theodora, H. H. Druce, Ent. Mo. Mag. vol. xxii. p. 155 (1885).

Elopura (*Pryer*).

Differs from the typical form by the blue on the upperside being rather more extensive and of a paler, greenish shade, but on the underside cannot be separated.

I have examined the specimen from Singapore figured by Mr. Distant[1] as the female of *N. amrita* and find that it is that sex of *Jacoona anasuja*, Feld., the black streak at the base of the costal nervure being distinctly present, although it has apparently escaped the notice of both its describer and his artist.

NEOCHERITRA TEUNGA.

Sithon teunga, Grose Smith, Ann. & Mag. Nat. Hist. ser. 6, vol. iii. p. 317 (1889).

Kina Balu (*Whitehead*).

I have not seen this species, which appears to be very distinct.

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[1] *Neocheritra amrita*, Dist. Rhop. Malay. p. 252, pl. xx. fig. 15 (1885).

Mr. de Nicéville supposes it to belong to this genus (J. A. S. B. vol. lxiii. pt. ii. no. 1, p. 43, 1894).

JACOONA, Distant.

JACOONA JUSANA, sp. n. (Plate XXXIV. fig. 3 ♂.)

♂. Allied to *J. anasuja*, Feld. Upperside—fore wing: outer margin convex, and with the blue fascia which is beyond the cell large and semicircular, extending from the costal margin across the wing down to the first median nervule and almost reaching the outer margin; the inner marginal blue area is also much more extensive, and reaches nearly to the anal angle. Hind wing with the blue area also much more extensive; the black marginal spot between the first and second median nervules much smaller; a distinct black line along the centre of the tail (not always present), and with the apex considerably more produced. Underside ochraceous hoary, but without the rufescent brownish; the outer margins as in *J. anasuja*, and with the third spot of the inner series and the corresponding spot of the outer series small and straight; a prominent black streak at the base of the costal nervure in the fore wing.

♀ much like that sex of *N. amrita*, Feld. Upperside white; anal area more extensive, and the black spots more inclined to separate. Underside as ♂, but yellowish ochraceous.

Expanse, ♂ $1\frac{4}{5}$, ♀ $2\frac{1}{5}$ inches.

Sandakan (*Mus. Druce*); Labuan (*Waterstr.*, *Mus. Staud.*).

Messrs. Godman and Salvin possess a male *J. anasuja*, Feld., from Sumatra (*Sachs*), also a female from Singapore.

The females in this genus have the same number of subcostal nervules in the fore wing as the males, but the first branch is entirely separate from the costal nervure. They closely resemble those of *N. amrita*, with which species they have doubtless often been confounded, and like that species possess a tail on the lower median nervule (which is, however, shorter); but they can be at once distinguished from that species by the presence on the underside of the prominent black basal streak in the fore wing.

JACOONA METASUJA, sp. n. (Plate XXXIV. fig. 4 ♂.)

Iolaus metasuja, Staud. MS.

♂. Allied to *J. jusana*, paler and brighter blue with greenish reflections; the band on the fore wing, beyond the cell, much narrower and shorter, and the blue basal area shorter. Underside as in *J. jusana*.

♀. Upperside differs from ♀ *jusana* by the white anal area being more extensive and the black spots entirely separated. Underside as ♂.

Expanse, ♂ $1\frac{9}{10}$, ♀ 2 inches.

Kina Balu (*Waterstr.*). Types Mus. Staud.

The greenish reflections and the narrow blue apical band give *J. metasuja* a very distinct appearance. The females of the three described species are much alike, but in the examples before me do not show any variation. Dr. Staudinger has received a considerable number of female *metasuja* from Kina Balu.

CHERITRA, Moore.

CHERITRA FREJA, var. OCHRACEA, nov.

Hesperia freja, Fab. Ent. Syst. iii. p. 263 (1793).
Sithon freja, Druce, P. Z. S. 1873, p. 351.
Cheritra freja, Distant & Pryer, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 269 (1887).

Differs from the Continental Indian form by the whole of the fore wing as well as the costal half of the hind wing below being ochraceous, and by the inner black band towards the anal angle being much broader and less broken.

Sandakan (*Pryer*); Labuan (*Low* and *Waterstr.*); Sarawak, S.E. Borneo.

This apparently is the usual Bornean form of the species, as in a large number of specimens before me there is no variation. Mr. Distant's figure[1] of *C. freja* shows a form intermediate between the Indian and Bornean representatives.

CHERITRA PALLIDA.

Sithon pallida, Druce, P. Z. S. 1873, p. 352, pl. xxxiii. fig. 3.
Sithon pallida, Distant & Pryer, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 268 (1887).

Sandakan (*Pryer*); Labuan (*Low*).

I have examined the type of this species and find that it is nearly allied to *C. freja* var. *ochracea*, the tails on the first median nervule being broken off. It agrees in neuration exactly with that species. On the upperside it can be distinguished by its rich purple colour in all lights, and by the distinct and even black margins. On the underside it differs from *C. freja* var. *ochracea* only by the black markings being more extensive and by the inner black band being situated higher up the wing. The metallic blue line is placed on the black, not above it as stated in the original description, and the black spot in the submedian interspace, which in *C. freja* and in var. *ochracea* is nearly obsolete, is in *C. pallida* large and distinct.

The type specimen, now in Messrs. Godman and Salvin's collection, is the only specimen I have seen.

It is, I believe, a perfectly good and distinct species.

RITRA, de Nicév.

Butt. India etc. iii. p. 411 (1890).

RITRA AUREA.

Sithon aurea, Druce, P.Z.S. 1873, p. 352, pl. xxxiii. fig. 1.
Ritra aurea, de Nicév. Butt. India etc. iii. p. 411 (1890).

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[1] Rhop. Malay. pl. xx. fig. 10 (1885).

♀. Upperside—fore wing dark brown, with the disc thickly dusted with cupreous-orange scales: hind wing dark brown, crossed below the middle by a band composed of white crescent-shaped lunules divided by the brown veins; beyond this two large brown spots which crown two rather large white spots; an anteciliary brown line: tails more slender than in ♂, with brownish central lines. Underside as in ♂, but paler.

Labuan (*Low* and *Waterstr.*).

Both sexes are contained in Messrs. Godman and Salvin's collection, including the type. The extent of cupreous orange on the upperside varies considerably in the female, as in one specimen sent by Dr. Staudinger the apex and outer margin of the fore wing only are brown.

HORAGA, Moore.

HORAGA CORNICULUM, sp. n. (Plate XXXIV. fig. 8 ♂.)

♂. Closely allied to *H. holothura*, Swinhoe, from which it differs on the upperside by the blue colour being of a paler and duller shade and not extending beyond the discal spot except below the first median nervule. The white discal spot is smaller and sharply bordered by the lower median nervule, not continued below it as in *H. holothura*. Underside—ground-colour rather paler than in *H. holothura*, but the white discal band, which commences on the subcostal nervure, narrower and pointed in the fore wing and of about equal width in the hind wing. Thorax and abdomen bluish above, whitish below. Legs white, with black spots.

Expanse $1\frac{3}{10}$ inch.

Kina Balu (*Waterstr.*). Type Mus. Staud.

The black spots and metallic markings towards the anal angle below are arranged as in *H. holothura*, Swinhoe, from Java, in which, judging from four specimens before me, I can detect no variation.

HORAGA AFFINIS, sp. n. (Plate XXXIV. fig. 9 ♂.)

Sithon affinis, Stgr. MS.

♂. Allied to *H. corniculum*, but the blue colour darker in shade and less extensive in the fore wing. The white discal spot is very small indeed, and is divided by the two brown median nervules just at their origin. Underside much like that of *H. corniculum*, but darker and the discal bands rather narrower. Thorax and abdomen bluish above, yellowish beneath. Legs white, with black spots.

Expanse $1\frac{2}{5}$ inch.

Kina Balu and Labuan (*Waterstr.*).

The type specimen from Labuan is in Dr. Staudinger's collection. The example from Kina Balu has the lower half of the white discal spot on the fore wing above rather larger than the type, and the blue area is rather paler; on the underside it is the same.

H. affinis and *H. corniculum* both possess the oval ochreous patch on the underside of the fore wing near the middle of the submedian nervure.

HORAGA MÆNALA.

Myrina mænala, Hew. Ill. Diurn. Lep., *Lyc.* (Supp.) p. 7, pl. iii. figs. 85, 86 (1869).

Borneo (*Hew.*).

This insect is known to me only by Hewitson's type in the British Museum. It is, I believe, the only species of the group without a white discal spot on the fore wing above.

CATAPŒCILMA, Butler.

CATAPŒCILMA ELEGANS.

Hypochrysops elegans, Druce, P. Z. S. 1873, p. 351, pl. xxxii. fig. 12.

Catapœcilma elegans, Distant & Pryer, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 267 (1887).

Labuan (*Low* and *Waterstr.*); Sandakan (*Pryer*).

The two Bornean specimens (females) before me differ from Sikkim examples by the central band on the fore wing below being straight, not Y-shaped, as appears to be invariably the case in Indian specimens, also in those from Ceylon, and again from Sumatra. On such slight material I do not propose to admit at present that the Indian representatives belong to a distinct species (they are certainly not typical), but in the event of their requiring a name I would suggest *major*.

The type is in Messrs. Godman and Salvin's Collection, and is in rather bad condition.

The figure given in the P. Z. S. 1873, pl. xxxii. fig. 12, is a very poor one, but suffices to show that the band on the fore wing is straight. Since the above was written Dr. Staudinger has sent me a male from Labuan which differs from Sikkim males by being entirely without the black outer margins to both wings on the upperside.

SEMANGA, Distant.

(*Keraunogramma*, Röber.)

SEMANGA SUPERBA.

Ilerda? superba, Druce, P. Z. S. 1873, p. 350, pl. xxxii. fig. 11, ♀.

♂. Upperside dark shining purple with brown borders; fore wing with a large central patch of darker, differently-placed scales; hind wing with an orange patch divided by the brown nervules as in the ♀. Underside as ♀.

Hind wing with two tails only, viz., a short one on the lower median nervule and a rather long one on the submedian nervure.

Labuan (*Low* and *Waterstr.*).

The male described above is from Dr. Staudinger's collection, and has the same number of subcostal nervules in the fore wing as the female, but has two tails only in place of three. The type (a female) is now in Messrs. Godman and Salvin's collection, but is somewhat mutilated, having lost its head and fore legs. The figure given in the P. Z. S. is a fairly good one, excepting that the median line on the fore wing is too distinct.

K. (=*S.*) *helena*, Röber, Iris, i. pt. 3, p. 198, pl. ix. fig. 6, is a closely allied species (if, indeed, it is distinct), which appears to have the purple colour rather less extensive on both wings.

BIDUANDA, Distant.

Below will be found described two remarkably interesting new species of this genus, viz. *B. similis* and *B. imitata*, both of which agree exactly in venation with the type of the genus, *B. thesmia*, Hew., and possess three subcostal nervules to the fore wing. They are remarkable in both being identical in other respects with two well-known species of the genus *Marmessus*[1], Hübn.,—*B. similis* being like *M. moorei*, Distant, whilst *B. imitata* is again the facsimile of *M. boisduvalii*, Moore. Boisduval (Spec. Génér. i. pl. 22) figures both *M. lisias*, Fab. (=*M. boisduvalii*, Moore), and *M. ravindra*, Horsf., with three subcostal nervules to the fore wing; but as these drawings are obviously incorrect—the costal nervure appearing to be given off from the subcostal nervure—I do not think any reliance can be placed upon them, at any rate *M. ravindra* and *M. boisduvalii*, as we now know them, have not this third subcostal nervule.

BIDUANDA THESMIA.

Myrina thesmia, Hew. Ill. Diurn. Lep., *Lyc.* p. 32, pl. xiv. figs. 25–27 (1863).

Labuan (*Low*); Sarawak (*Wallace*, *Wahnes*).

Messrs. Godman and Salvin's collection contains two female specimens, which agree with Hewitson's type and also with a Sumatran female. Wahnes has also sent it to Dr. Staudinger from Labuan.

Var. UNICOLOR.

Sithon thesmia, var. *unicolor*, Staud. Iris, ii. p. 111 (1889).

Labuan (*Low*); Sandakan (*Pryer*); Elopura (*Pryer*); Kudat (*Mus. Druce*); Kina Balu (*Waterstr.*).

This appears to be the common form in Borneo and agrees exactly with Dr. Staudinger's type from Palawan. Some females are entirely without the white scales at the anal angle of the hind wings.

It is distinguished from the typical form by the underside being dull reddish brown in place of rufous orange.

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[1] Mr. de Nicéville states that this name should be used in place of *Drupadia* Moore.

It also occurs in N.E. Sumatra.

Some males have a large orange spot on the disc, others a small one, and others again are without any.

BIDUANDA ESTELLA, var.

Sithon estella, Hew. Ill. Diurn. Lep., *Lyc.* p. 31, pl. xvi. figs. 50, 51 (1863).

Kina Balu Mts. (*Waterstr.*).

Dr. Staudinger has sent me a pair (♂ ♀) which agree well with Hewitson's types from Sumatra, but are somewhat larger. It is distinguished at once from *B. thesmia* by the broken band on the fore wing below. The specimens referred to *Sithon estella* by Mr. Herbert Druce (P. Z. S. 1873, p. 352) are *B. unicolor* described above.

BIDUANDA THÆNIA, sp. n. (Plate XXXIV. fig. 2 ♀.)

♀. Upperside dull brown; fore wing crossed about the middle with an oblique, whitish, indistinctly bordered band reaching from the subcostal nervure, where it is narrowest, nearly to the submedian nervure. Hind wing narrowly whitish along the costal margin; three blackish spots at the anal angle between the tails. Underside white, with spots and markings arranged as in Hewitson's figure of *B. theda*; but the spots in the cell of the fore wing are reduced to mere dots, and the markings on the hind wing are linear excepting those near the base.

Expanse $1\frac{1}{5}$ inch.

Sandakan (*Pryer*). Mus. G. & S.

The type specimen is unique. When the male is found it will probably be much like that sex of *B. theda*, Hew., and *B. thesmia*, Hew. It can be distinguished from *B. theda* by the linear markings on the hind wings below, and the much less distinct whitish band on the fore wing above.

BIDUANDA CINESIA.

Myrina cinesia, Hew. Ill. Diurn. Lep., *Lyc.* p. 29, pl. xiii. figs. 18, 19 (1863).

♀. Upperside dull blackish brown; fore wing slightly tinged with cupreous towards the centre; hind wing darker towards anal angle, and with a broad, distinct, waving white band not crossed by dark nervules, margin dusted with white between the tails. Tails equal in length to those of male. Underside as in male.

Expanse $1\frac{3}{5}$ inch. (Hew. fig. ♂ $1\frac{7}{10}$ inch.)

Sarawak (*Hew.*); Elopura (*Pryer*); Kina Balu (*Waterstr.*).

Hewitson's figure of the female undoubtedly represents another species, as, besides being smaller and having the central tail considerably longer than in *B. cinesia*, it presents other differences which I have described below.

Mr. Pryer took this species in March.

Dr. Staudinger has received both sexes from Kina Balu, the female having the white band slightly wider than the typical form.

BIDUANDA CINEAS.

Sithon cineas, Grose Smith, Ann. & Mag. Nat. Hist. ser. 6, vol. iii. p. 318 (1889).

Kina Balu (*Whitehead*).

Mr. Grose Smith states that this species is nearest to *S. cinesia*, Hew., and *S. maneia*, Hew. The type is in Mr. Whitehead's collection. I have not seen a specimen, but it would appear to be quite distinct. *S. cineas*, Hew., and *S. maneia*, Hew., are, however, not allied to each other.

BIDUANDA HEWITSONII, sp. n.

Myrina cinesia, ♀, Hew. Ill. Diurn. Lep., *Lyc.* p. 29, pl. xii. fig. 20 (1863).

♀. Allied to *B. cinesia* but smaller; upperside with the white band rather narrower and divided by brown nervules. Underside ochreous yellow, darker and richer in colour, the inner black band on the hind wing narrower and not so much waved; the outer black band also is straighter and is without the distinct black tooth which is so conspicuous in *B. cinesia*. Middle tail considerably longer.

Expanse $1\frac{1}{10}$ inch.

Elopura (*Pryer*) (*Mus. Druce*); Labuan (*Waterstr.*).

The specimen described above was taken by Mr. Pryer in March and agrees exactly with Hewitson's figure, no. 20, plate xii., which, now that we have the correct female of his *B. cinesia*, requires a name.

B. hewitsonii should be easily distinguished from *B. cinesia* on the upperside by the white band on the hind wing being crossed by brown nervules.

The male is unknown.

Dr. Staudinger has sent me two females, and Mr. H. Grose Smith possesses one specimen, also a female.

BIDUANDA STAUDINGERI, sp. n. (Plate XXXIV. figs. 5 ♂, 6 ♀.)

♂. Upperside—fore wing dark purplish blue, outer margin narrowly and evenly black, costal margin very narrowly black; cilia black. Hind wing dark purplish blue, costal and outer margin down to third median nervule narrowly and evenly black; anal third, including tails, cream-white, with a black band beyond its middle divided by the nervules, extending from the second median nervule at the point at which the wing is dentated to the lobe, the inner edge of the white area being sinuous; cilia along costal margin and apex pale yellowish, rest of wing white. Costal fold bluish grey. Underside pale brown, darker towards apex and outer margin of fore wing, palest towards anal angle of hind wing; a faint wavy dark line in fore wing beyond the middle, commencing near the costa and becoming more distinct towards the submedian nervure, on which it broadens into an irregular spot. Hind wing with a similar faint wavy line beyond the middle, starting on the costa and running nearly straight to the second median nervule, where it turns at right angles, and becoming suddenly darker and thicker reaches almost to the anal margin just before the extremity of the abdomen; a large black spot on the lobe crowned with metallic green; a black mark between the submedian nervure and another joining it between the two lower median nervules, both covered with metallic green scales; a thin black marginal line above the lobe, running into the dark band, also dusted with metallic green; dark anteciliary lines towards the anal angle. Cilia of fore wing dark brown, of hind wing pale brown at apex, nearly white towards anal angle. Tails on both surfaces unmarked. Head, thorax, abdomen, and legs concolorous with wings; tarsi black-spotted.

♀. Differs from the male only by upperside being rich dark brown in place of purplish blue, and the anal region pure white in place of cream-white. Underside as male, but the pale brown replaced by rich ochreous brown.

Expanse, ♂ $1\frac{1}{10}$, ♀ $1\frac{3}{5}$ inch.

Kina Balu (*Waterstr.*).

I have named this fine species after Dr. Staudinger, whose kindness and generosity have enabled me to describe and figure it here. The types are in his collection. It is not a little remarkable in that both sexes are nearly alike on the upperside, the female only differing from the male by being brown in place of blue. The third (upper) tail is very slightly developed in the male, but is well marked in the female. *B. staudingeri* is not closely allied to any other species.

BIDUANDA SIMILIS, sp. n.

♂. Upperside—fore wing dark rich brown; hind wing shining cærulean blue, with brown apex and costal margin, two black spots near anal angle; cilia of fore wing brown, of hind wing white. Underside—fore wing reddish orange with brown markings; hind wing white, with dark brown markings and bands, reddish along the costal margin and dusted with shining silvery green scales towards the anal angle. Outer margin of fore wing more convex, about equal to that of *M. moorei* ♀.

Expanse $1\frac{7}{10}$ inch.

Borneo. Type Mus. Druce.

This butterfly differs from the common *Marmessus moorei*, Distant, with which it occurs, only by the presence of an additional subcostal nervule, and by the outer margin being more convex. The type specimen, so far as I know, is unique, as after examining a large series of *M. moorei* I have failed to find another example. This specimen, together with the type of *B. imitata*, mihi, next described, was formerly in the Rev. R. P. Murray's collection, but unfortunately the precise locality in Borneo is not noted.

BIDUANDA IMITATA, sp. n.

♀. Upperside much like *M. boisduvalii*, Moore, ♀, differing only from that species by the greyish-blue scales towards the anal angle of the hind wing being more extensive. Underside—ground-colour of fore wing pale yellow, whitish at the base and with a broad pale brown apex; a short dark brown streak near the base, a circular dark brown spot ringed with white between the base and a broad brown band which crosses the middle of the cell; a short pale band closing the end of the cell, with a separated spot over it close to the costal margin, beyond this a dusky, dark-bordered, rather broad band from the second subcostal nervule to the submedian nervure, broken on the third median nervule and palest in median interspaces, and halfway between this and the outer margin a dusky line divided by the nervules. Hind wing with markings and spots arranged as in *M. boisduvalii*, but all of a dark brown colour and with the apex very faintly pale yellowish.

Expanse $1\frac{1}{2}$ inch.

Borneo. Type Mus. Druce.

B. imitata is remarkable for its close resemblance to *M. boisduvalii*, but we have no knowledge of that species occurring in Borneo.

MARMESSUS, Hübn.

(*Drupadia*, Moore.)

MARMESSUS MOOREI.

Sithon moorei, Dist. Ann. & Mag. Nat. Hist. ser. 5, vol. x. p. 246 (1882); Rhop. Malay. p. 236, pl. xx. figs. 21, 29, 30 (1886).

Sithon ravindra, Druce (nec Horsf.), P. Z. S. 1873, p. 351.

Kina Balu (*Waterstr.*); Elopura (*Pryer*); Labuan (*Low* and *Waterstr.*); Daat Island (*Distant*); Trusan and Lawas (*Everett*).

This is a common insect at Labuan, and Mr. Low's collections contained a large number of specimens.

MARMESSUS SURINDRA, sp. n. (Plate XXXIV. fig. 7 ♂.)

♂. Closely allied to *M. ravindra*, Horsf., from which it differs on the upperside by the blue on the hind wing, which is of a deeper shade, extending to the apex and close along the subcostal nervure to the glandular patch; and on the underside by the band beyond the cell in the fore wing being linear its entire length, not widening out at the end of the cell as in that species.

Var. ALBULA, nov.

♂. Differs on the underside by the ground of the fore wing being pure white, with the apex and outer margin fuscous ochreous, and the black markings on both wings smaller.

♀. Upperside dark brown, bluish grey towards anal angle. Underside as male.

Kina Balu (*Waterstr.*); Sandakan (*Pryer*); S.E. Borneo (*Wahnes*). Mus. G. & S., Staud., and Druce.

M. surindra may prove to be a seasonal form of *M. moorei*, but at present we have no evidence in that respect. The var. *albula* appears to be as common as the typical form at Sandakan, whence all the specimens I have examined have come. Messrs. Godman and Salvin possess a male and female from Palawan, which agree with var. *albula*. Dr. Staudinger has sent me the types of his *S. ravindrina*, ♂ ♀; these agree with *S. surindra*, but on the underside the fore wings are bright ochreous yellow.

Messrs. Distant and Pryer record *D.* (=*M.*) *ravindra*, Horsfield, from Sandakan, but as the specimens represent *M. surindra* I have not included the species in my list.

EOOXYLIDES, de Nicév.

EOOXYLIDES THARIS.

Oxylides tharis, Hübn. Zutr. exot. Schmett. figs. 883, 884 (1837).

Sithon tharis, Druce, P. Z. S. 1873, p. 351.

Hypolycæna tharis, Distant & Pryer, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 268 (1887).

Kina Balu (*Everett* and *Waterstr.*); Trusan (*Everett*); Labuan (*Low*); Sarawak (*Staud.*); Sandakan.

Bornean specimens of this insect show scarcely any (and in some examples no) trace of the blue scales along the inner margin of the fore wing above, in the male, which character seems best developed in specimens from Nias Island, which possess it in a marked degree—in one example in our collection it extends from the margin to the middle of the cell[1].

EOOXYLIDES ETIAS.

Hypolycæna etias, Distant & Pryer, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 268 (1887).

Sandakan (*Pryer*).

I have not seen this species, and have placed it in this genus judging from the description and the remark that it is allied to *H.* (=*E.*) *tharis*. It appears to have a more extensive white area on the hind wing above than that species.

LOXURA, Horsf.

LOXURA ATYMNUS.

Papilio atymnus, Cr. Pap. Exot. vol. iv. p. 82, pl. cccxxxi. figs. D, E (1780).

Myrina alymnus, Druce, P. Z. S. 1873, p. 353.

Loxura cassiopea, Distant & Pryer, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 269 (1887).

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[1] *Myrina meduana*, Hew., which has been referred to *Eooxylides* by Herr Semper (Reise Phil. Ins.), has the glandular patch in the male oblong and placed at the end of the cell. The neuration, however, appears to be much the same.

Labuan (*Low* and *Waterstr.*); Sandakan (*Pryer*).

All Labuan specimens I have examined are dark in colour, even darker than the S. Indian form named *L. surya* by Mr. Moore.

DRINA, de Nicév.

DRINA NINODA, sp. n.

♂. Allied to *D. donina*, Hew., but larger and with a distinct white spot close to outer angle of fore wing in the submedian interspace, and two dull brownish-green pale patches—one, an elongate oval, between the first and second median nervules; the other placed below it in the submedian interspace, square. Underside: bands broader and more distinct, notably that one which crosses the fore wing beyond the cell, which is also straighter.

Expanse $2\frac{2}{5}$ inches.

Labuan (*Low*). Type Mus. G. & S. Sandakan (*Elwes*).

Although closely allied to *D. donina*, the additional patches and spot described above are sufficient to distinguish it. I have examined a number of *D. donina* from Burmah, but find no traces of these patches in any of them.

DRINA MANEIA.

Myrina maneia, Hew. Ill. Diurn. Lep., *Lyc.* p. 29, pl. xii. figs. 14, 15 (1863).

Sithon maneia, Druce, P. Z. S. 1873, p. 351.

Labuan (*Low* and *Waterstr.*).

Messrs. Godman and Salvin's collection contains two males of this species, one of which agrees with Hewitson's figure, with the addition of the brown lines and nervules as described by Mr. Doherty in a specimen from Perak (J. A. S. B. vol. lx. pl. 2. no. 1, p. 34, 1891); the other, which is somewhat larger, has a much narrower brown outer margin to the fore wing, and is without the brown lines and nervules. Dr. Staudinger has sent me the female.

ARAOTES, Doherty[1].

ARAOTES LAPITHIS.

Myrina lapithis, Moore, Horsf. & Moore, Cat. Lep. Mus. E. I. C. vol. i. p. 48 (1857).

Sithon lapithis, Druce, P. Z. S. 1873, p. 351.

Labuan (*Low* and *Wahnes*); S.E. Borneo, near Banjarmasin (*Wahnes*).

The width of the white band on the fore wing below varies somewhat. It is a common species—the male apparently being most seldom met with, as out of 15 specimens before me three only are of that sex.

Messrs. Godman and Salvin's collection contains a female from Sumatra (*Sachs*).

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[1] *Nec* de Nicév., *vide* Zool. Record, 1889.

SITHON, Hübn.

SITHON NEDYMOND.

Papilio nedymond, Cram. Pap. Exot. vol. iv. p. 19, pl. ccxcix. figs. E, F, ♂ (1780).

Thecla chitra, Horsf. Cat. Lep. E. I. C. p. 97, pl. i. fig. 5, ♀ (1829).

S.E. Borneo, near Banjarmasin (*Wahnes*); S. Borneo (*coll. G. & S.*).

I quite agree with Mr. de Nicéville that *P. nedymond*, Cr., and *T. chitra*, Horsf., are respectively male and female of one species. Messrs. Godman and Salvin's collection contains a female from Bankasoon, Burmah (*Hume*), which on the underside is exactly intermediate in colour and markings between the usual forms of the two sexes.

SITHON MICEA.

Myrina micea, Hew. Ill. Diurn. Lep., *Lyc.* Supp. p. 6, t. 3. fig. 81, ♂ (1869).

Sithon valida, Druce, P. Z. S. 1873, p. 352, pl. xxxiii. fig. 4, ♀.

Kina Balu (*Waterstr.*); Labuan (*Low*).

The male of *S. micea* is easily distinguished from that sex of *S. nedymond* by the coloration of the underside, by the blue area of the fore wing reaching close down to the outer angle, and by the blue band on the outer margin of hind wing being much broader. The tuft of hairs attached to the inner margin of fore wing on the underside is a darker shade of buff than in *S. nedymond*, and both wings are narrower and longer.

The female, however, is so close to that sex of *S. nedymond* that I am unable to state how it can be distinguished. The inner black band on the hind wing below is generally broader than in *S. nedymond*, but this is a variable character in the 4 specimens I have examined, including the type (a female), which are in Messrs. Godman and Salvin's collection. There can be, I think, no doubt that *S. valida* is the female of *S. micea*, as both have been sent together from Labuan and Kina Balu, whilst true *S. nedymond* appears only to occur in Southern Borneo.

The original description of *S. valida* is quite incorrect, the insect being on both surfaces practically indistinguishable from *S. chitra*, Horsf. The figure also is indifferent and does not show the marks at the ends of the cells nor the median darker lines.

The expanse of the type specimen is $1\frac{3}{10}$ inch, not 1 inch as stated, whilst other specimens measure $1\frac{1}{2}$ inch.

DEUDORIX, Hew.

DEUDORIX EPIJARBAS.

Dipsas epijarbas, Moore, Horsf. & Moore, Cat. Lep. Mus. E. I. C. vol i. p. 32 (1857).

Deudorix epijarbas, Druce, P. Z. S. 1873, p. 353.

Labuan (*Low* and *Waterstradt*).

Several specimens quite typical.

DEUDORIX STAUDINGERI, sp. n. (Plate XXXIV. fig. 10 ♂.)

♂. Upperside dark brown; fore wing dusted with reddish brown, of a darker shade than in *D. epijarbas* and much less extensive. Hind wing: outer margin, from subcostal nervule where it is broadest to lobe rather narrowly and evenly dark reddish brown, crossed by black nervules; the three median nervules dusted with reddish brown from their bases nearly to the brown outer margin. Lobe yellow, with a large black spot and a few blue scales. In some lights both wings are suffused with dark purple, that on the hind wing being most conspicuous. Underside much as in *D. epijarbas*, with a slightly reddish tinge and the white lines rather more sordid. Abdomen reddish brown above, pale buff below.

Expanse $1\frac{9}{10}$ inch.

Labuan (*Waterstr.*).

I have named this fine species after Dr. Staudinger, by whose kindness I am able to describe it here and whose collection contains the type and only specimen I have seen. It is a true *Deudorix* as defined by Mr. de Nicéville and should be easily recognized.

RAPALA, Moore.

RAPALA DELIOCHUS.

Deudorix deliochus, Hew. Trans. Ent. Soc. 1874, p. 352; id. Ill. Diurn. Lep., *Lyc.* Supp. p. 31, pl. v. *a.* figs. 68, 69, ♂ (1878).

Labuan (*Waterstr.*).

Dr. Staudinger has sent a single female of this species which agrees well on the underside with Hewitson's type. *Thecla* (=*R.*) *kessuma*, Horsf., which we possess from Java (♂ ♀), and which I have compared with Horsfield's type (♀) in the British Museum, is a very closely allied species; the male on the upperside is scarcly distinguished from that sex of *R. deliochus*, but the female *kessuma* has a larger and paler blue area. On the underside the ground-colour of *R. kessuma* is paler and the white band at the end of the cell, which in *R. deliochus* is continued straight almost to the submedian nervure, is in *R. kessuma* broken at the third median nervule, the lower portion being placed further out and closer to the third band. From the available material these differences, although slight, seem to hold good, but when more specimens can be examined it may be found that the two species are synonymous. Mr. de Nicéville has described the female *deliochus* from Rangoon (Butt. Ind. etc. iii. p. 457). They are very curious species, and I may mention that I found Horsfield's type in the British Museum collection placed under the genus *Nacaduba*, species of which on the underside it much resembles.

RAPALA SPHINX.

Papilio sphinx, Fab. Syst. Ent. p. 520 (1775).

Kina Balu (*Waterstr.*).

The apex of the fore wing is less broadly black in specimens before me than is usual in Javan specimens. The dark fasciæ on the underside vary somewhat in width.

RAPALA SCHISTACEA.

Deudorix schistacea, Moore, P. Z. S. 1879, p. 140.

S.E. Borneo, near Banjarmasin (*Wahnes*).

The underside has a purplish tinge, as is usual in Javan specimens. It appears to be common there, as we have received a number of specimens.

RAPALA SCINTILLA.

Rapala scintilla, de Nicév. Butt. Ind. etc. iii. p. 461 (1890).

Kina Balu (*Waterstr.*).

Waterstradt's specimens are identical with some in our own collection from Sikkim. It is a very distinct species.

RAPALA VARUNA.

Thecla varuna, Horsf. Cat. Lep. E. I. C. p. 91 (1829).

Deudorix orseis, Hew. Ill. Diurn. Lep., *Lyc.* p. 23 (1863); Druce, P. Z. S. 1873, p. 353.

Deudorix kinabalina, Staud. MS.

Kina Balu (*Waterstr.*); Labuan (*Low* and *Waterstr.*).

I have examined Horsfield's type in the British Museum and find that it is the form in which the discal bands on the underside are broad and amalgamated with the bands closing the ends of the cells as described by Mr. de Nicéville; both forms occur together with intermediates in Borneo and in Java as they do Sikkim, so I do not hesitate to sink Hewitson's name. The ground-colour also varies from stone-colour to dark chocolate-brown.

Below[1] will be found the description of a species obtained in large numbers in S. Celebes by Mr. Doherty, and for which I am unable to find a name. Dr. Holland, in his "List of the Diurnal Lepid. taken by Mr. Doherty in Celebes" (P. Boston Soc. Nat. Hist. vol. xxv. 1890), does not mention it.

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[1] RAPALA OLIVIA, sp. n. (Plate XXXIV. fig. 16 ♂.)

♂. Upperside allied to *R. orseis* (= *R. varuna*), and like that species without any purple gloss, but with the apex of the fore wing a blacker shade of brown and with the green more extensive, especially in the hind wing, where it reaches even closer up to the black anteciliary line. Cilia of hind wing pure white from just below apex to base of wing. Lobe pale orange with a black spot; extremity of cilia to lobe and between lobe and tail black. Fore wing without the patch of differently placed scales at the base of the median nervules. Underside dark greyish brown with a greenish tinge; both wings with the usual mark at the end of the cell and fascia, beyond both of which are distinctly bordered with sordid white, except towards the anal margin of hind wing, where the borders become pure white. The black lobe is large and prominent, as is also the black orange-crowned spot between the lower median nervules; a patch of blue scales in the submedian interspace close to the margin. Cilia of fore wing brown, of hind wing white as above. Abdomen blackish above, buff-colour below.

Expanse $1\frac{1}{2}$ inch. Type Mus. Druce.

S. Celebes (August and September).

Dr. Staudinger having kindly sent me the types of his Palawan *Lycænidæ* for examination, I find that his *D. anabasis* is allied to *R. suffusa*, Moore, his *D. varuna*, Horsf. = *R. sphinx*, Fab., and that his *D. schistacea*, Moore, is a species without any purple gloss on either wing and = *R. orseis* = *R. varuna.*

RAPALA CHOZEBA.

Deudorix chozeba, Hew. Ill. Diurn. Lep., *Lyc.* p. 24, pl. v. figs. 47, 48 (1863).

Kina Balu (*Waterstr.*); Labuan (*Low* and *Waterstr.*).

Several specimens agreeing well with Hewitson's type. The female is dull purplish brown on the upperside, darkest at the margins and with darker veins; on the underside it is like the male. The species appears to be quite a distinct one.

RAPALA PHERETIMA.

Deudorix pheretima, Hew. Ill. Diurn. Lep., *Lyc.* p. 21, pl. ix. figs. 27–29 (1863).

Deudorix metajarbas, Staud. MS.

Kina Balu and Labuan (*Waterstr.*); Sarawak (*Hew.*).

R. pheretima apparently takes the place of *R. petosiris*, Hew., in Borneo. The lower half of the club of the antennæ is broadly white-ringed, giving it quite an unusual appearance; this, however, is present only in the male.

RAPALA XENOPHON.

Hesperia xenophon, Fab. Ent. Syst. vol. iii. pt. 1, p. 272 (1793).

Kina Balu, Labuan (*Waterstr.*).

♀ var. CÆRULESCENS.

Deudorix intermedius, var. *cærulescens*, Staud. Lep. Palaw. p. 116 (1889).

Sandakan (*Pryer*).

Messrs. Godman and Salvin's collection contains a female specimen which agrees well with Dr. Staudinger's type of *D. intermedius*, var. *cærulescens*; his male is identical with typical *xenophon*, Fab.

RAPALA BARTHEMA. (Plate XXXIV. fig. 11 ♂.)

Deudorix barthema, Dist. Rhop. Malay. p. 280 (1885).

♂. Differs from ♀ on the upperside by being darker brown, and by the hind wing being rich cupreous brown with the costal margin broadly brown and crossed by brown nervules. Underside as ♀. The tuft of hair at end of abdomen is buff-colour.

Kina Balu, Labuan (*Waterstr.*).

The male described above has no purple shading, and if I am correct in identifying the species it is not conspecific with *R. suffusa*, Moore, as suggested by Mr. de Nicéville (Butt. Ind. p. 467). I have before me two females which agree with Mr. Distant's description, and which on the underside are exactly like the male here described.

Rapala laima, sp. n. (Plate XXXIV. fig. 12 ♂.)

♂. Upperside dull greyish brown, inner margin of fore wing, also disc of hind wing, in some lights slightly cupreous. Anal fold and sexual patch pale buff-colour. Lobe pale orange with a black spot. Underside much as in *R. barthema*, but considerably paler, and with the fasciæ less distinct, the lobe, which is black, smaller, as is also the black spot between the lower median nervules. Abdomen brown above, yellowish below, with a tuft of buff-coloured hair at its extremity.

♀. Upperside uniform dull brown without any cupreous gloss. Underside as ♂.

Expanse, ♂ $1\frac{3}{10}$, ♀ $1\frac{1}{10}$ inch.

Kina Balu (*Waterstr.*); Sandakan (*Pryer*).

This dull-coloured species appears to be distinct from any I can find described. It has a less robust appearance than any others of the genus. The male is in Dr. Staudinger's collection, the female in Messrs. Godman and Salvin's.

Rapala drasmos, sp. n. (Plate XXXIV. fig. 13 ♀.)

♀. Upperside rich dark brown, shining, with the disc of the fore wing brownish orange (much the colour of *R. jarbas*, Fab., ♀, but paler), crossed by brown nervules. The nervules also of the hind wing are a darker shade of colour than the rest of the wing. Lobe pale orange with a black spot. Underside somewhat paler than is usual in *R. xenophon*, Fab., and with the fasciæ broader, straighter, and more distinct.

Expanse $1\frac{3}{10}$ inch.

Labuan (*Waterstr.*). Type Mus. Staud.

Dr. Staudinger has sent me a single female of this species. It should be easily recognized by the coloured disc of the fore wing. I have not seen the male.

Rapala domitia.

Deudorix domitia, Hew. Ill. Diurn. Lep., *Lyc.* p. 19, pl. vi. figs. 6, 7 (1863).

Deudorix domitia, Druce, P. Z. S. 1873, p. 353.

Labuan (*Low* and *Waterstr.*).

Dr. Staudinger possesses a male which has the dash in the cell pale yellow dusted with brown; the costal margin and anal fold of hind wing also are broadly pale yellow, and the apex of the fore wing is dusted with white scales. The underside is very pale, scarcely darker along the inner margin on the fore wing. The sexual patch on the hind wing, which in all other species of *Rapala* that I have examined is large and conspicuous, is in *R. domitia* small, elongate, close to the subcostal nervure, and difficult to see, thereby approaching the genus *Deudorix*.

BINDAHARA, Moore.

BINDAHARA PHOCAS.

Sithon phocides, Fab., var. *phocas*, Staud. Iris, ii. p. 114 (1889).
Sithon sugriva, Druce (nec Horsf.), P. Z. S. 1873, p. 351.

Labuan (*Low* and *Waterstr.*).

Dr. Staudinger has sent me his type, male, for examination, and I find that Bornean specimens are identical with it. *B. phocas* is perhaps nearest to *B. isabella*, Feld., but the hind wing is less produced apically, and the cyaneous patch extends down to the first median nervule, and besides the black spot in the lobe there is usually a rather large black spot in the first median interspace close to the margin. The female on the upperside is rich cupreous, and on the underside the bands and spots are pale reddish brown. It is as much worthy of specific distinction as any other species in the genus. Messrs. Godman and Salvin's collection contains *B. phocas* from Celebes and from the Philippine Islands.

SINTHUSA, Moore.

SINTHUSA NASAKA.

Thecla nasaka, Horsf. Cat. Lep. E. I. C. p. 91 (1829).
Hypolycæna terna, Staud. MS.

Kina Balu (*Waterstr.*).

Dr. Staudinger has sent both sexes from Kina Balu, the male being identical with Horsfield's type in the British Museum. I quite fail to see how *S. amba*, Kirby, can be distinguished from *S. nasaka*, and in my opinion should be placed as a synonym of it. Mr. Doherty (J. A. S. B. vol. lviii. 1889) has possibly mistaken the next species (*S. amata*) for *S. nasaka*, as the whole of the hind wing of that species, except the basal portion of the costal margin, is cyaneous.

SINTHUSA AMBA.

Hypolycæna amba, Kirby (Hew.), Ill. Diurn. Lep., *Lyc.* Supp. p. 32, pl. v. *b*. figs. 44–46 (1878).

Sinthusa amba, Distant & Pryer, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 268 (1887).

Sandakan (*Pryer*).

Included here only on the authority of Messrs. Distant and Pryer.

SINTHUSA AMATA.

Sinthusa amata, Dist. Rhop. Malay. p. 461, pl. xliv. fig. 20, ♀.

♂. Upperside differs from *S. nasaka* ♂ by being less densely black, by the purple area of the fore wing being duller and less extensive, by the blue of the hind wing, which is sharply bordered by the subcostal nervure, being paler and of a decided violaceous shade, and not resplendent when held at an angle. The hairs which are thickly strewn on the median interspaces are white, those in *S. nasaka* being black. Underside as ♀, but apex of fore wing more greyish ochreous.

Kina Balu (*Waterst.*). Mus. Staud. and Druce.

The females before me appear to agree perfectly with Mr. Distant's description and figure; and as the male is undoubtedly distinct from *S. nasaka*, I have described it here, feeling sure that I have correctly identified the species.

LIPHYRA, Westw.

LIPHYRA BRASSOLIS, Westw.

Liphyra brassolis, Westw. P. Ent. Soc. ser. 3, vol. ii. p. 31 (1864).

Sarawak (*Hew.*).

The Hewitson collection contains a specimen of this species labelled "Sarawak."

EXPLANATION OF THE PLATES.

PLATE XXXI.

Fig. 1. *Paragerydus waterstradti*, sp. n., ♂, p. 562.
2. —— ——, ♀, p. 562.
3. *Gerydus gigas*, sp. n., ♂, p. 559.
4. —— *innocens*, sp. n., ♂, p. 560.
5. *Paragerydus moorei*, sp. n., ♂, p. 562.
6. —— ——, ♀, p. 562.
7. —— *caudatus*, Grose Smith, ♂, p. 563.
8. —— ——, ♀, p. 563.
9. *Gerydus vincula*, sp. n., ♂, p. 561.
Fig. 10. *Gerydus vincula*, sp. n., ♀, p. 561.
11. *Allotinus audax*, sp. n., ♂, p. 564.
12. —— ——, ♀, p. 564.
13. *Logania staudingeri*, sp. n., ♂, p. 565.
14. —— ——, ♀, p. 565.
15. *Poritia phaluke*, sp. n., ♂, p. 567.
16. —— *phormedon*, sp. n., ♂, p. 566.
17. —— ——, ♀, p. 566.
18. —— *phama*, sp. n., ♂, p. 568.

PLATE XXXII.

Fig. 1. *Poritia philura*, sp. n., ♂, p. 569.
2. *Cyaniris dilectissima*, sp. n., ♂, p. 571.
3. —— ——, ♀, p. 571.
4. —— *strophis*, sp. n., ♂, p. 573.
5. —— *lugra*, sp. n., ♂, p. 573.
6. —— *placidula*, sp. n., ♂, p. 572.
7. —— ——, ♀, p. 572.
8. —— *plauta*, sp. n., ♂, p. 574.
9. —— ——, ♀, p. 574.
10. —— *selma*, sp. n., ♂, p. 573.
11. —— *ripte*, sp. n., ♂, p. 574.
12. *Niphanda reter*, sp. n., ♂, p. 576.
Fig. 13. *Nacaduba aluta*, Druce, ♂, p. 578.
14. —— ——, ♀, p. 578.
15. —— *lugine*, sp. n., ♂, p. 577.
16. *Lampides limes*, sp. n., ♂, p. 581.
17. —— *virgulatus*, sp. n., ♂, p. 581.
18. —— *zebra*, sp. n., ♂, p. 583.
19. —— *cærulea*, Druce, ♀, p. 582.
20. —— *lividus*, sp. n., ♂, p. 584.
21. *Tarucus waterstradti*, sp. n., ♀, p. 585.

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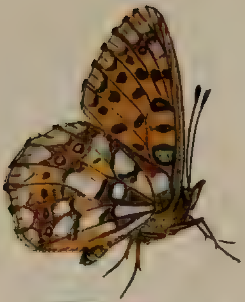
NATURAL HISTORY.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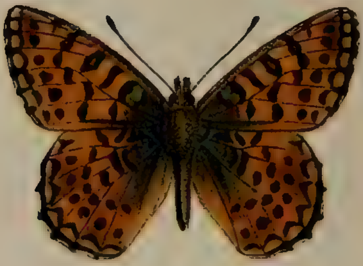
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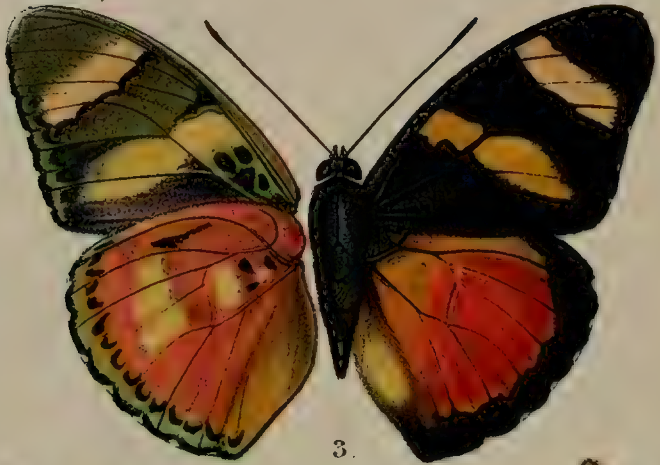
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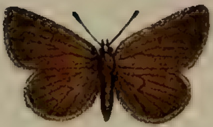
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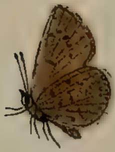
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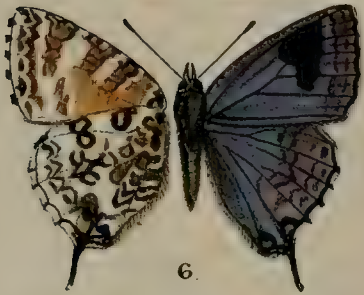
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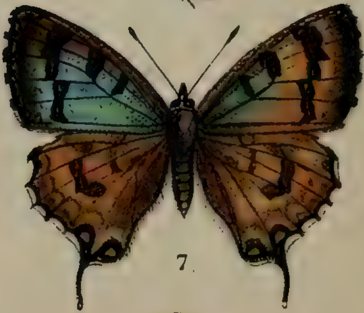
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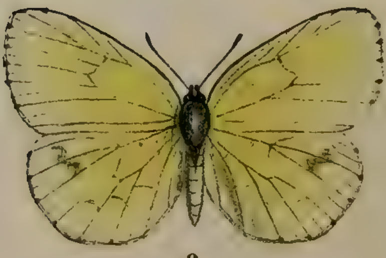
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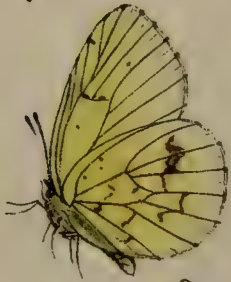

9.

F. W. Frohawk del. et lith.
Mintern Bros. Chromo.

NEW BUTTERFLIES FROM NYASA-LAND.

Plate XXXIII.

Fig. 1. *Iraota nila*, Dist., ♂, p. 588.
2. *Arrhenothrix lowii*, sp. n., ♂, p. 596.
3. *Pratapa lucidus*, sp. n., ♂, p. 596.
4. —— *devana*, sp. n., ♂, p. 597.
5. —— ——, ♀, p. 597.
6. —— *calculis*, sp. n., ♂, p. 598.
7. —— ——, ♀, p. 598.
8. *Tajuria tussis*, sp. n., ♂, p. 601.
9. —— ——, ♀, p. 601.
Fig. 10. *Tajuria cyrus*, sp. n., ♂, p. 600.
11. —— ——, ♀, p. 600.
12. —— *dominus*, sp. n., ♂, p. 600.
13. —— *cato*, sp. n., ♂, p. 601.
14. —— ——, ♀, p. 601.
15. *Pratapa sannio*, sp. n., ♂, p. 596.
16. *Hypolycæna skapane*, sp. n., ♂, p. 604.
17. —— ——, ♀, p. 604.
18. —— *phemis*, sp. n., ♂, p. 604.

Plate XXXIV.

Fig. 1. *Chliaria mimima*, sp. n., ♂, p. 605.
2. *Biduanda thænia*, sp. n., ♀, p. 614.
3. *Jacoona jusana*, sp. n., ♂, p. 609.
4. —— *metasuja*, sp. n., ♂, p. 609.
5. *Biduanda staudingeri*, sp. n., ♂, p. 615.
6. —— ——, ♀, p. 615.
7. *Marmessus surindra*, sp. n., ♂, p. 617.
8. *Horaga corniculum*, sp. n., p. 611.
9. —— *affinis*, sp. n., ♂, p. 611.
Fig. 10. *Deudorix staudingeri*, sp. n., ♂, p. 621.
11. *Rapala barthema*, Dist., ♂, p. 623.
12. —— *laima*, sp. n., ♂, p. 624.
13. —— *drasmos*, sp. n., ♀, p. 624.
14. *Poritia phare*, sp. n., ♂, p. 567.
15. *Poriskina phakos*, sp. n., ♂, p. 570.
16. *Rapala olivia*, sp. n., ♂, p. 622.
17. *Cyaniris phuste*, sp. n., ♂. p. 573.

5. On a small Collection of Butterflies sent by Mr. Richard Crawshay from the country west of Lake Nyasa. By Arthur G. Butler, Ph.D., F.L.S., F.Z.S., &c., Assistant-Keeper of the Zoological Department, British Museum.

[Received June 12, 1895.]

(Plate XXXV.)

The present consignment was forwarded to me by Mr. Sclater early in the present year; although very small, it is decidedly interesting, and the specimens, with only one or two exceptions, are in the admirable condition characteristic of Mr. Crawshay's collections. Five new species are now described.

The following extract from a letter to our Secretary evidences the careful and methodical manner in which Mr. Crawshay collects:—

"The collection I send is a very small one, made in Nyika chiefly, two days west from here (Deep Bay, Lake Nyasa). Some few of the specimens I send should prove new on account of the high altitude from which they come. Several are from an altitude of 7000 feet or so, the highest plateau-land (Mlanji Mountain excepted) anywhere in B. C. Africa, I fancy. I have numbered each species in its paper, and have given as well (in brackets) the number of the individual specimens of each, locality, date of capture, and some rough distinguishing name for my own guidance. A few notes on what seem to me the most interesting insects may be of use."

These notes I propose to quote under the species to which they refer, as thereby no confusion can by any possibility arise.

The *Danainæ* and *Satyrinæ* are unrepresented in the present little series.

1. JUNONIA TUGELA.

Precis tugela, Trimen, S. Afr. Butt. p. 241, pl. iv. fig. 5.

♀. Foot of Nyika Plateau, west of Lake Nyasa, Sept. 6th, 1893. "Tortoiseshell" (*R. C.*).

When describing the allied *J. aurorina*, I compared it with *J. sinuata*; it is, however, more nearly related to *J. kowari* from the Cameroons, differing in the narrower truncated (not falcated) apex of the primaries, and longer, more tapering secondaries, in the tawny markings in the cell of primaries, the much narrower discal belt, which is distinctly paler, much less red, and less suffused with pink, also in the deep incision in this band formed by the strong and prominent angulation of the brown basal area of the anterior wings. Comparing our four examples with the four specimens of *J. kowari* in the Hewitson collection, I find all these characters absolutely constant.

2. PYRAMEIS CARDUI.

Papilio cardui, Linnæus, Faun. Suec. p. 276 (1761).

♂, Kantorongondo Mountain, Nyika, west of Lake Nyasa, Sept. 18th, 1893. "Painted Lady" (*R. C.*).

3. EUPHÆDRA CRAWSHAYI, sp. n. (Plate XXXV. fig. 3.)

♂. Allied to *E. zaddachii* and *E. elephantina*, but differing from both in the broader and more regular ochreous bands on the primaries, with other characters to be described: primaries greenish black, glossed with bright green at base; an oblique broad ochreous trifid band just before the middle, from subcostal vein to middle of interno-median areole, a second oblique quadrifid band (pale pinky ochreous or flesh-coloured) limiting the apical area, and of nearly uniform width throughout; fringe flecked and tipped with white: secondaries greenish black at base, costal border purplish slate-colour; subcostal area ochraceous; discoidal cell, almost to extremity, veins, and basal half of interno-median area bright golden ochreous; abdominal border pale ochreous brownish or testaceous, shading into smoky brown at anal angle;

disc of wing rosy blood-red, with diffused ochreous external edge; external border jet-black, with white spots on the fringe at extremity of internervular folds: body blackish; eyes coppery bronze, varied with blue-black; head deep brown, with two white spots before and behind; pterygodes and front of thorax bronze-green, sides of thorax clothed with copper-brown hair; base of abdomen hairy, shot with blue and green. Below differing from *E. zaddachii* in the regular creamy bands of the primaries, the inner edge of the subapical band slightly concave, instead of elbowed, the lower half of the first band not incised internally; a large yellow patch filling the end of the cell of secondaries, and a still larger patch or abbreviated band beyond the cell, commencing at subcostal vein in an elongated subpyriform patch, the inferior portion of which is occupied by an acutely angled, almost ¬-shaped streak; from the first subcostal to the third median nervule the band is of a clearer yellow and gradually widens, its inner edge being unequally trisinuated and not accompanied by black spots: the submarginal spots are uniformly smaller than in *E. zaddachii*, but the remaining characters are similar. Expanse of wings 80 millim.

♂, Lumpi River, Nyika, west of Lake Nyasa, Sept. 19th, 1893. "Cream, velvet, and crimson" (*R. C.*).

4. METACRENIS ROSA.

♀. *Crenis rosa*, Hewitson, Ent Month. Mag. xiv. p. 82 (1877).

♂. *Crenis pechuelii*, Dewitz, Nov. Act. Acad. Nat. Cur. vol. xli. pl. xxvi. fig. 1 (1879).

♂, Deep Bay, 1500 feet altitude, west of Lake Nyasa, March 4th, 1894. "Violet Fritillary" (*R. C.*).

Mr. Crawshay says of this species:—"I have only seen three, during a year's residence here in 1893 and 1894, and long stays in previous years. It is of swift flight, and very difficult to catch, as it perches on trees, high up, out of one's reach as a rule. I at first took this insect for another which I got at Mweru, and which Mr. Butler was kind enough to name after me—viz., *Crenis crawshayi*; but, on closer examination, I see it is not the same except in general tone of colour."

5. ARGYNNIS SMARAGDIFERA, sp. n. (Plate XXXV. figs. 1, 2.)

♂. Intermediate in character between *A. lathonia* and *A. euphrosyne*; size, form, and general pattern of the upper surface of the latter, but the base of the wings with the basal area broadly greyish green, the marginal spots of the primaries pale yellowish towards apex, and the centre of the secondaries spotted almost as in *A. lathonia*: wings below perfectly intermediate between these two very distinct species, the ground-colour of the apex of the primaries being characteristic of *A. euphrosyne*, clear yellow with similar ferruginous patches; the greater portion of the primaries, however, is of a dull tawny hue; the subbasal **D**-shaped black marking in the cell encloses a shining green spot; the silver markings on all the wings are arranged nearly as in *A. lathonia,* but are much more uniform in size; the characteristic oblong spot beyond the cell of secondaries is larger than that in *A. euphrosyne*, but smaller than that in *A. lathonia.* Expanse of wings 46 millim.

Kasungu Mountain, Nyika, west of Lake Nyasa, Sept. 2nd, 1893. "Silver-speckled Fritillary" (*R. C.*).

Mr. Crawshay has the following note on this butterfly:—"No. 1 I took at the very summit of Kasungu Mountain, on open downland, covered with short, crisp, curly grass, only about ankle-high, I don't think I saw more than three, two of which I took (one I have by me). It is an exceedingly restless insect, of erratic flight, and, when on the wing, is a bad colour to follow with the eye. I did not find it anywhere but on the very top of the mountain; 100 feet or so lower down I did not see one."

6. ACRÆA EXCELSIOR.

Acræa excelsior, E. M. Sharpe, P. Z. S. 1891, p. 192, pl. xvii. fig. 3.

♂, Kasungu Mountain, Nyika, west of Lake Nyasa, Sept. 2nd, 1893. "Small Red-barred Fritillary" (*R. C.*).

Of this insect Mr. Crawshay says:—"A little Fritillary from nearly the top of Kasungu may prove good. I saw only one, which I took in the same place as the great Blue No. 2."

Although the *Acræinæ* somewhat remind one of Fritillaries, they belong to a different subfamily.

7. POLYOMMATUS BÆTICUS.

Papilio bæticus, Linnæus, Syst. Nat. i. 2, p. 789 (1767).

♀, Kantorongondo Mountain, Nyika, west of Lake Nyasa, Sept. 5th, 1893. "Blue" (*R. C.*).

It is almost impossible to get a collection from any part of the Old World which does not contain an example of this species and *Pyrameis cardui.*

8. LYCÆNESTHES (sp. near *L. liodes*).

♀, Kasungu Mountain, Nyika, west of Lake Nyasa, Sept. 2nd, 1893. "Dull-marked Blue" (*R. C.*).

This species has almost exactly the same pattern as *L. liodes*, but the secondaries are elongated and with an abrupt elbow close to anal angle; although probably new, the single specimen is unfortunately a good deal injured.

9. ZIZERA UNIGEMMATA, sp. n. (Plate XXXV. figs. 4, 5.)

♂. Allied to *Z. lysimon*: above smoky grey-brown, with faint lilacine gloss; a slender blackish marginal line: secondaries with a submarginal black spot with paler diffused edging; slightly orange at the back near extremity of first median interspace; fringes smoky greyish, darker on the primaries than the secondaries, with blackish subbasal line followed by a whitish stripe: body blackish. Under surface mouse-grey, with markings somewhat as in *Z. lysimon*, but the primaries with pale-edged black reniform discocellular spot; discal series consisting of five whitish-edged conspicuous black spots, the interno-median area being crossed by two white lunules, to represent the lower spots of *Z. lysimon*; submarginal and marginal markings normal: secondaries with only three nearly equidistant subbasal pale-edged black spots, and only the first spot of the discal series black, but in the submarginal series the sixth spot is centred with a black spot edged with metallic blue. Expanse of wings 23 millim.

♂, Kasungu Mountain, Nyika, west of Lake Nyasa, Sept. 2nd, 1893. "Tiny Blue" (*R. C.*).

10. SCOLITANTIDES STELLATA?

Lycæna stellata, Trimen, Trans. Ent. Soc. 1883, p. 349.

Kasungu Mountain, Nyika, west of Lake Nyasa, Sept. 2nd, 1893. "Tiny dull Blue" (*R. C.*).

11. ZERITIS HARPAX.

♀. *Papilio harpax*, Fabricius, Syst. Ent. App. p. 829 (1775).

♀, Deep Bay, 1500 feet altitude, west of Lake Nyasa, March 11th, 1894. "Large Copper ♀, with emerald-green legs" (*R. C.*).

An unusually large example, and redder underneath than in the majority of specimens.

URANOTHAUMA, gen. nov.

Allied to *Spindasis* and *Hyreus*: primaries with four subcostal branches, the first emitted from halfway to end of discoidal cell, anastomosing with costal vein, the second at one-third distance from end of cell, the third from halfway between cell and apex, the fourth running to just before the apex: secondaries with one rather long tail near anal angle; costal margin slightly sinuous; neuration quite normal: abdominal half of wings below clothed with long hairs; abdominal margin densely hairy; eyes, pectus, and legs to end of femora densely hairy. Male with a large velvety black patch on the upper surface of the primaries immediately beyond the cell.

Typical species, with the anal angle lobed and the tail emitted from a second more prominent lobe: *U. crawshayi*.

This genus will include *Hyreus cordatus*, E. M. Sharpe, from Sotik, Kavirondo.

12. URANOTHAUMA CRAWSHAYI, sp. n. (Plate XXXV. figs. 6, 7.)

♂. Rufous brown, shot with bright violet, excepting on the costal and abdominal borders of the secondaries; fringes white, spotted with black at the extremity of the veins, most heavily on the primaries; a large velvety black patch beyond the cell of these wings, having on the left-hand wing somewhat the outline of the letter **P**; fringe of abdominal margin of secondaries sordid white; two black submarginal spots above the anal lobes, that above the tailed lobe large and enclosing a conspicuous metallic ultramarine transverse spot, that above the inner lobe partly enclosing a metallic golden-green spot, tinted along its upper edge with blue; tail black, tipped with white: body blackish, clothed in front with slaty-grey hairs, behind, but especially at the sides, with silvery brownish hairs, abdominal segments very slenderly edged with whitish; antennæ black, slenderly ringed with white to the base of the clavus; palpi long, black with a white lateral stripe, the broad fringes formed of mixed white and black hairs; pectus and venter white; legs white, barred with black. Wings below chalky white: primaries with an **8**-shaped black basal patch (which in the female becomes a **3**), three clay-reddish bands commencing in partly blackish annular markings on the costa, uniting into a broad argillaceous patch below the cell; all the other markings very nearly as in *U. cordatum*, Sharpe, but much heavier in character, the fourth band of the primaries being also continued across these wings by the addition of two argillaceous spots almost touching the outer edge of the patch of that colour; the black spot above the tail of secondaries united on its outer edge to a metallic tricoloured ʊ-shaped patch, the projecting parts of which are blue, and the enclosed portion fiery copper, shading at the edges into green; anal spot edged on one side by an oblique blue and copper dash. Expanse of wings 42 millim.

♀ slightly larger, more rufous, almost argillaceous, the primaries with the whole surface, excepting the costal and external areas, brilliant *Morpho*-blue; a transverse narrow **8**-shaped bar across the cell, a quadrate patch at the end of the cell, a series of six subconfluent spots across the disc, interrupted at second median nervule, and the outer border black: secondaries with an annular series of blackish spots as follows—two closing the cell, three in a curved series beyond the cell, and one near the base of the subcostal areole; a few other spots vaguely showing through from the under surface; margin of wing blackish; fringes, metallic spots, tails, and pattern of under surface as in the male. Expanse of wings 45 millim.

Kasungu Mountain, Nyika, west of Lake Nyasa, Sept. 2nd, 1893. "Giant Blue" (*R. C.*).

Mr. Crawshay has the following note on this lovely species:—"No. 2 is a Blue, also from Kasungu, and from nearly the top of the mountain. It seems fairly plentiful, at least I saw perhaps ten or a dozen, of which I took four. It is of rapid, buzzing, humming-bird, moth-like flight, and feeds restlessly, hovering almost the whole time. The sunny side of flowering trees and shrubs is its favourite haunt; as long as the sun is bright it is very restless and active. It is a Blue, and yet does not feed in the deliberate way in which the majority of Blues feed; its wings are never at rest."

13. COLIAS EDUSA, var. ELECTRA.

Papilio electra, Linnæus, Syst. Nat. i. 2, p. 764 (1767).

♂ ♂ and ♀ (*C. helice* type), Kasungu Mountain, Nyika, west of Lake Nyasa, Sept. 2nd, 1893.

♀ ♀ (both forms), Kantorongondo Mountain, Nyika, Sept. 18th, 1893. "Clouded Yellow and Pale Clouded Yellow" (*R. C.*).

Mr. Crawshay remarks:—"The Clouded Yellows do not differ in their habits from those I have taken in Great Britain. I got them all, with the exception of one, on the top of Kasungu. They are the first Clouded Yellows I have come across in B. C. Africa.

"The Pale Clouded Yellow, or whatever it is, may prove something good. The Dark Clouded Yellows, as far as I can judge, are merely small editions of the British *Colias edusa*.

"Of the Pale Clouded Yellows, I took two specimens (one I have). I took four specimens of the Dark Clouded Yellow, and could have taken more."

The "Pale Clouded Yellow" is only the usual albino form of the female; Mr. Crawshay sent us *two* specimens. One of the males does not differ in any respect from typical *C. edusa*; the other and the ordinary female are somewhat more yellow in tint, especially on the posterior wings, those of the female showing scarcely a trace of the usual orange suffusion.

14. TERIAS PUNCTINOTATA, sp. n. (Plate XXXV. figs. 8, 9.)

♀. Evidently a representative or geographical race of *T. desjardinsii*, from the female of which it differs in the total absence of the dark brown border of the primaries—all the wings above being uniformly primrose-yellow, paler towards the outer margins, and with brown-stained black dots at the extremities of the veins; on the under surface the reddish border and apical oblique streak of the primaries are wanting, and the subapical bilunate marking is dark ferruginous brown; the ground-colour is also paler. Expanse of wings 41–45 millim.

♀ ♀, Kasungu Mountain, Nyika, west of Lake Nyasa, Sept. 2nd, and Kantorongondo Mountain, Sept. 5th, 1893. "Brimstone (small)" (*R. C.*).

Speaking of the reduction in the width of the border in females of *T. desjardinsii*, Mr. Trimen says:—"Here the extreme of reduction breaks up the hind-marginal portion of the border into very nearly separated spots." Between this extreme and *T. punctinotata* there is a very considerable gap, but it may eventually be bridged over when the fauna of Africa is thoroughly known.

15. PAPILIO PSEUDONIREUS, var.?

Papilio pseudonireus, Felder, Reise der Nov., Lep. i. p. 94.

Above this example is black, with all the markings of a satiny Antwerp Blue, the fringes narrowly white between the veins: on the upper surface the central band is evidently wider than in

Felder's type; but the same submarginal dots in pairs occur on the primaries: on the under surface there is one marked difference, the primaries show a discal series of divided spots, the first four, from inner margin to lower radial, white, the fifth whitish, but indistinct, the remainder forming a blurred greyish band to costa; in the silvery white band of the secondaries and all other respects the specimen agrees with Felder's description; and knowing how much the allied *P. nireus* varies, I think it would be rash at present to regard this as a distinct species.

♂, Kasungu Mountain, Nyika, West of Lake Nyasa, Sept. 2nd, 1893. "Blue Swallow-tail" (*R. C.*).

Mr. Crawshay says:—"This is, I suppose, a Swallow-tail of sorts, or what an expert would call a *Papilio*? It is not a difficult insect to take, as it flops along lazily, and before perching hesitates a good deal. I found it only on the top of Kasungu, and saw three in all, of which I secured two."

Later on, we may perhaps receive other examples of this form, when it will be possible to decide whether the differences between it and typical *P. pseudonireus* are constant.

16. PAPILIO HORRIBILIS.

Papilio horribilis, Butler, Lep. Exot. p. 88, pl. xxxiv. fig. 2 (1872).

♂, Northern Henga, west of Lake Nyasa, Jan. 25th, 1894. "Chocolate Swallow-tail" (*R. C.*).

Of this species Mr. Crawshay writes:—"Taken in Henga, at about 3300 feet. I saw only one. It kept flying up and down a small stream with high banks, and gave me a lot of trouble to catch. My caravan was delayed on its account for the better part of half an hour."

17. PADRAONA WATSONI.

Padraona watsoni, Butler, P. Z. S. 1893, p. 671.

♂, Kantorongondo Mountain, Nyika, west of Lake Nyasa, Sept. 18th, 1893. "Orange-and-Black Skipper" (*R. C.*).

18. GEGENES LETTERSTEDTI.

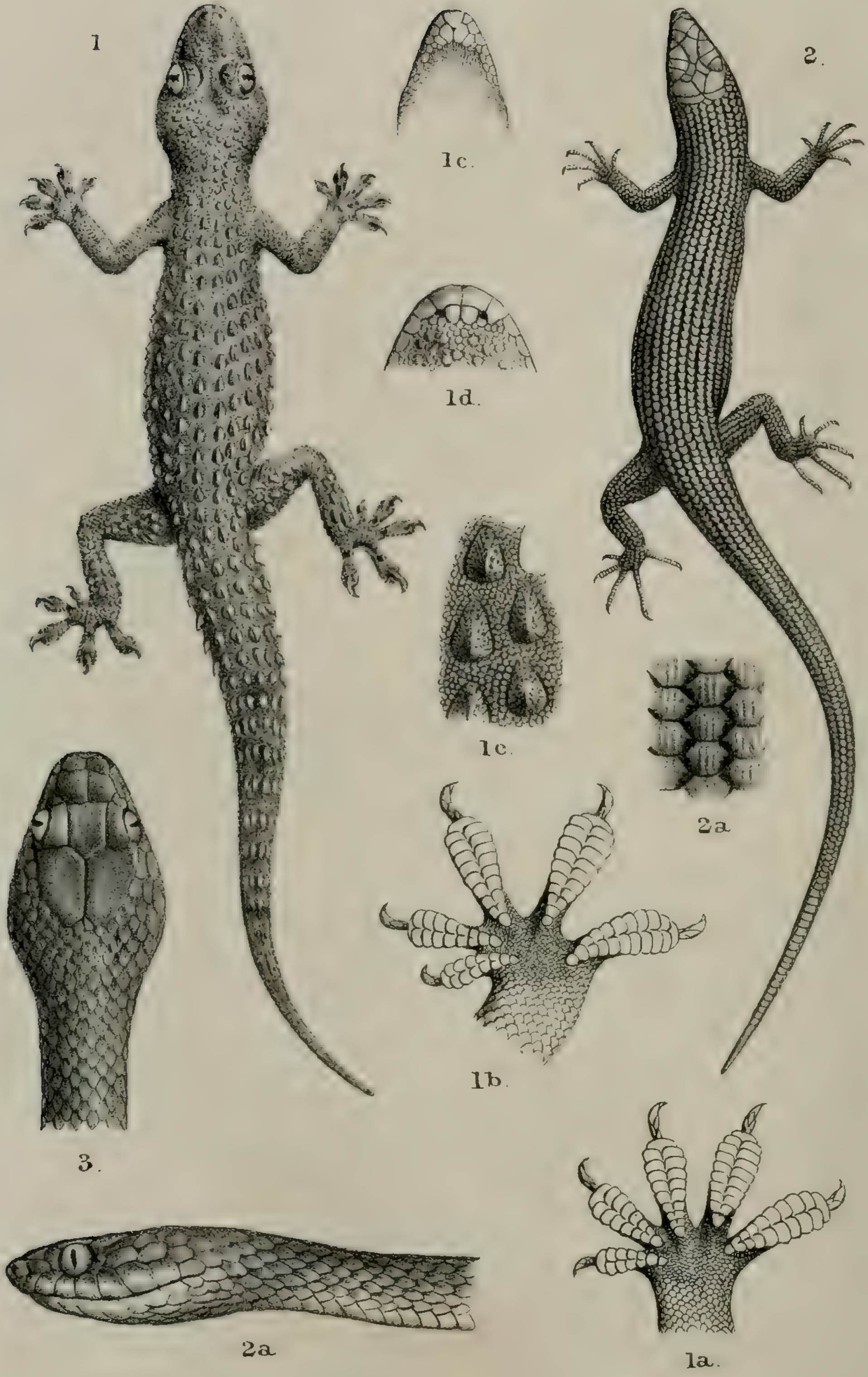
Hesperia letterstedti, Wallengren, Kongl. Svensk. Vet.-Akad. Handl. 1857; Lep. Rhop. Caffr. p. 49.

♂, Kasungu Mountain, Nyika, west of Lake Nyasa, Sept. 2nd, 1893. "Greenish Skipper" (*R. C.*).

EXPLANATION OF PLATE XXXV.

Figs. 1, 2. *Argynnis smaragdifera*, p. 629.
3. *Euphædra crawshayi*, p. 628.
4, 5. *Zizera unigemmata*, p. 630.
6, 7. *Uranothauma crawshayi*, ♂ ♀, p. 631.
8, 9. *Terias punctinotata*, ♀, p. 633.

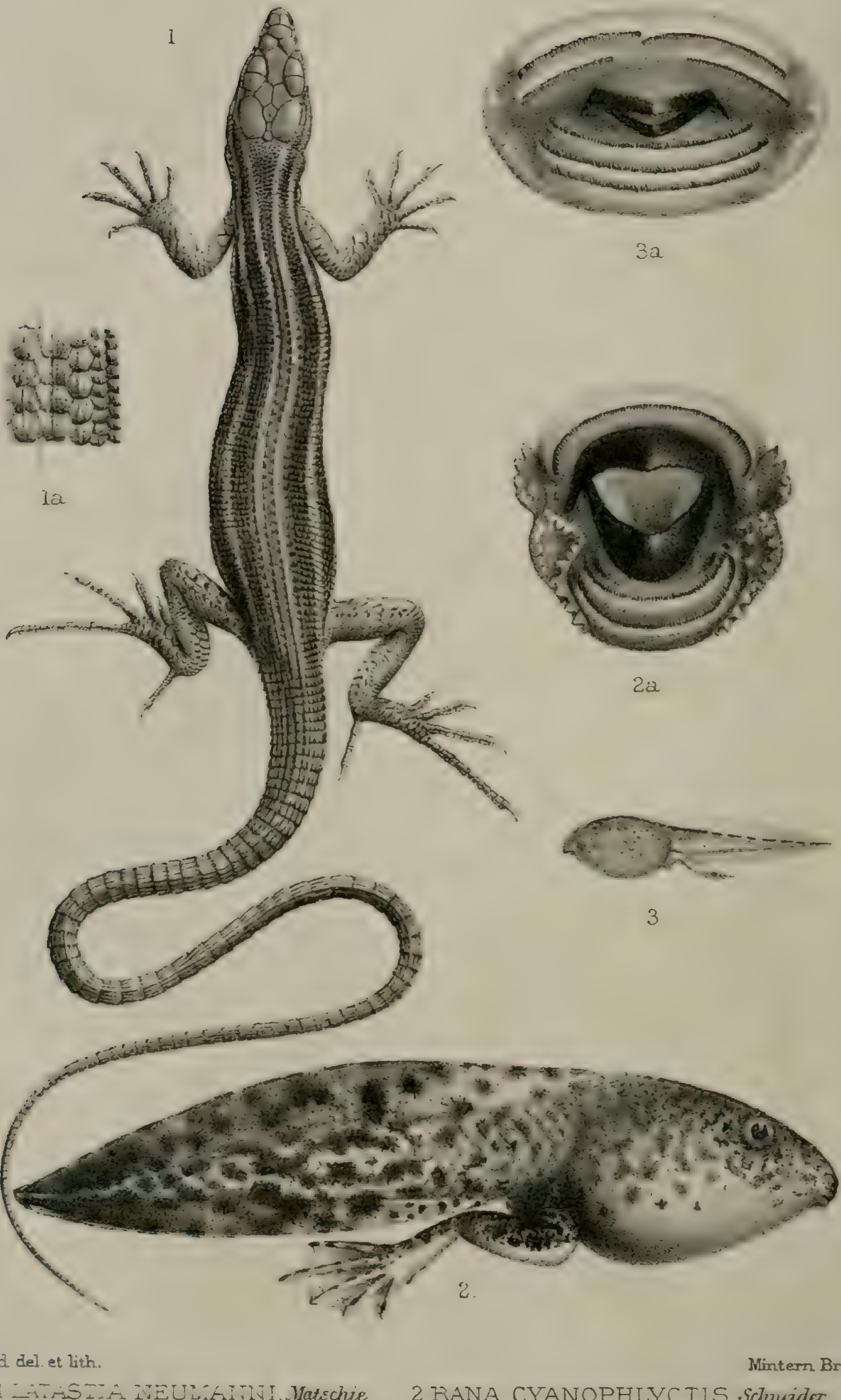
BRITISH MUSEUM
Z. D.
NATURAL HISTORY.



H. Grönvold del. et lith.
Mintern Bros. imp.

1. HEMIDACTYLUS YERBURII. *Andr.* 2. MABUIA TESSELLATA. *Andr.*
3. TARBOPHIS GUENTHERI. *Andr.*

BRITISH MUSEUM
Z D
NATURAL HISTORY.



H. Grönvold del. et lith.

Mintern Bros. imp.

1 LATASTIA NEUMANNI, *Matschie* 2 RANA CYANOPHLYCTIS. *Schneider.*
3. BUFO ANDERSONI, *Boulenger.*

6. On a Collection of Reptiles and Batrachians made by Colonel Yerbury at Aden and its Neighbourhood. By JOHN ANDERSON, M.D., LL.D., F.R.S., F.Z.S.

[Received June 18, 1895.]

(Plates XXXVI. & XXXVII.)

Colonel Yerbury has presented this collection to the British Museum, and I have to express my indebtedness to Dr. Günther for having entrusted its description to me, and also to Mr. Boulenger for his assistance and advice. It contains examples of 17 species of Lizards, 5 Snakes, and 3 Batrachians.

The specimens were collected at the following localities besides Aden itself, viz.: Shaikh Othman, five or six miles inland; the oasis of Lahej, 20 miles from Aden; and Haithalhim, 25 miles distant from the rock.

Considering that Aden has been in the possession of this country since 1839, it is rather remarkable that we are only now beginning to know something about its fauna, and very slow progress seems to attend the elucidation of its flora[1]. The literature bearing on its Reptiles and Batrachia can be summarized in a few words.

In Mr. Boulenger's Catalogue of the Lizards in the British Museum, only *Pristurus crucifer*, Val., and *Chamæleon calcarifer*, Peters, are recorded with Aden as a locality, and in the first volume of Snakes the only species mentioned from Aden is *Zamenis rhodorhachis*, Jan.

Professor Boettger[2], in 1892, recorded the occurrence of *Gymnodactylus scaber*, Heyden, *Hemidactylus coctæi*, Dum. & Bibr. = *H. flaviviridis*, Rüppell, *Scincus hemprichii*, Wiegm., *Chalcides ocellatus*, Forskål, *Zamenis ladacensis*, Andr. = *R. rhodorhachis*, Jan, and *Echis carinata*, Schneider; and in the following year Herr Matschie[3] added six other species, collected by Mr. Oscar Neumann, to those already known, viz.:—*Mabuia pulchra*, Matschie, = *M. brevicollis*, Wiegm., *Acanthodactylus boskianus*, Daud., *Philochortus neumanni*, Matschie, = *Latastia neumanni*, Matschie, *Lytorhynchus diadema*, D. & B., *Bufo arabicus*, Rüpp. (?= *Bufo pentoni*, Andr.), and *Rana ehrenbergi*, Peters, = *Rana cyanophlyctis*, Schneider.

In Colonel Yerbury's collection there are specimens of 11 species of Reptiles new to the fauna of Aden and its neighbourhood, and one Toad. Of the former, three are new to science.

I am indebted to Colonel Yerbury for some interesting notes on the occurrence and habits of many of the species. I have indicated his observations by inverted commas.

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[1] My brother wrote his 'Florula Adenensis' so long ago as 1856, and I am informed, on the best authority, that only very trifling additions have been made to it since.

[2] Ber. Offenb. Ver. 1892, pp. 61–63.

[3] SB. nat. Fr. 1893, pp. 27–31.

The following is a list of the Reptiles and Batrachia now known to occur in Aden and in the immediately surrounding country:—

LACERTILIA.

GECKONIDÆ.

1. *Ceramodactylus doriæ*, Blanford. Aden.
2. *Gymnodactylus scaber*, Heyden. Aden (*Boettger*).
3. *Pristurus crucifer*, Val. Kursi near Aden (*Boulenger*).
4. —— *flavipunctatus*, Rüppell. Aden; Lahej.
5. *Hemidactylus sinaitus*, Boulenger. Shaikh Othman; Lehaj.
6. —— *yerburii*, n. sp. Aden; Lahej; Haithalhim.
7. —— *flaviviridis*, Rüppell. Aden (*Boettger*); Shaikh Othman; Lahej.

AGAMIDÆ.

8. *Agama sinaita*, Heyden. Haithalhim.

VARANIDÆ.

9. *Varanus griseus*, Daud. Lahej; Haithalhim.

LACERTIDÆ.

10. *Latastia neumanni*, Matschie. Scadi near Lahej (*Matschie*); on road between Lahej and Shaikh Othman.
11. *Acanthodactylus boskianus*, Daud. Scadi near Lahej (*Matschie*); Aden, outside isthmus; Shaikh Othman; Lahej; Haithalhim.
12. —— *cantori*, Günther. Lahej.
13. *Eremias guttulata*, Licht. Lahej; Haithalhim.

SCINCIDÆ.

14. *Mabuia brevicollis*, Wiegm. Scadi near Lahej (*Matschie*); Shaikh Othman; Lahej; Haithalhim.
15. *Mabuia tessellata*, n. sp.
16. *Scincus hemprichi*, Wiegm. Aden (*Boettger*); Shaikh Othman; Lahej?
17. *Chalcides* (*Gongylus*) *ocellatus*, Forskål. Lahej (*Matschie*); Aden (*Boettger*); Shaikh Othman.

CHAMÆLEONTIDÆ.

18. *Chamæleon calcarifer*, Peters. Aden (*Boulenger*); Shaikh Othman; Lahej; Haithalhim and Huswah.

OPHIDIA.

COLUBRIDÆ (*Aglypha*).

19. *Zamenis rhodorhachis*, Jan. Aden (*Boettger*).
20. *Lytorhynchus diadema*, D. & B. Lahej (*Matschie*).

(*Opisthoglypha.*)

21. *Psammophis lacrymans*, Reuss. Shaikh Othman; Haithalhim; Lahej.
22. *Cœlopeltis moilensis*, Reuss. Aden, sands outside isthmus.
23. *Tarbophis guentheri*, n. sp. Muscat; The Hadramaut (*Bent Expedition*); Lahej.

VIPERIDÆ.

24. *Echis carinata*, Schneider. Aden (*Boettger*); Lahej.

BATRACHIA.

RANIDÆ.

1. *Rana cyanophlyctis*, Schneider. Lahej (*Matschie*); Haithalhim.

BUFONIDÆ.

2. *Bufo pentoni*, Anderson. Lahej; Haithalhim.
3. —— *andersoni*, Boulenger. Lahej.

? *Bufo arabicus*, Rüpp. Aden (*Matschie*).

The foregoing list is doubtless very imperfect, and it will be observed that it does not contain a single Chelonian, either from the land or water, and no marine snakes. Every section of the fauna of Aden is of extreme interest owing to the geographical position of the locality and its proximity to the African coast. The question whether any sea-snakes are found on the coast is one well worthy of the attention of any resident at Aden interested in the geographical distribution of animals. Sir Lambert Playfair informs me that he has never heard of them at Aden or anywhere in the Red Sea, but that he has seen them off the coast of Arabia, when going from Zanzibar to Bombay. They are unknown at the former locality. Colonel Yerbury says he has never met with a sea-snake at Aden, and that he does not believe that they exist there, or he would certainly have met with them when he was collecting marine shells and seining. Sea-snakes are common at Muscat, indeed they occur there rather in profusion. To what cause is their apparent absence at Aden to be attributed? If not entirely absent from the Aden sea they must be extremely rare, as many good observers have visited both sides of the Gulf and not a single instance of their occurrence has been recorded in zoological literature.

LACERTILIA.

1. CERAMODACTYLUS DORIÆ, Blanford.

Ceramodactylus doriæ, Blanford, Ann. & Mag. N. H. (4) xiii. 1874, p. 454.

1 ♂.

This is the first record of the occurrence of this species at or near Aden, but in the British Museum there are examples from Muscat[1], from the Sinaitic peninsula, and one from Arabia[2] presented by the late Sir Richard Burton, and, therefore, probably from Midian.

2. Pristurus flavipunctatus, Rüppell.

Pristurus flavipunctatus, Rüppell, Neue Wirbelth. 1835, Rept. p. 17, pl. vi. fig. 3.

13 ♀. Aden: "common on the rocks."

4 ♂, 5 ♀. Lahej: "common on the trunks of babool trees."

In the British Museum there is a single example of this species from Shaikh Othman, presented by Marquis Doria. These specimens now prove the species to be distributed over the Aden district, where it appears to be quite as common as it is on the opposite African coast; but Colonel Yerbury informs me that it is extremely difficult to capture owing to the rapidity of its movements.

The spots which occur on the sides of this little Gecko of rocks and trees are rich blood-red in freshly preserved specimens. They are very minute, generally not larger than two granules, and are chiefly confined to the sides, from the axilla to the groin, and to the sides of the belly. The brilliancy of these spots induced me to examine them with a hand-lens, when I was surprised to find that many of the supposed coloured spots of the lizard were due not to skin-pigment but to the presence of a minute mite simulating their colour. I submitted a portion of the skin to the high authority of Mr. Albert D. Michael, who was so good as to examine it, and he informs me that the minute mite belongs to the genus *Gekobia*, and that it is either identical with, or very similar to, *G. loricata*, Berlese. Mr. Michael is disposed to think that it is identical, but says that there may be some minute differences which can only be detected by actual dissection, and, moreover, that it is difficult to compare spirit-specimens, which shrink, with Berlese's drawing made from life; he therefore leaves the question of the species in abeyance. Berlese's specimens were found, Mr. Michael informs me, "in a precisely similar situation under the scales of *Platydactylus muralis*" (*Tarentola mauritanica*, Linn.) "in South Italy."

In the males of these specimens the crest of the tail may be traced on to the sacral region, but not beyond it.

All the specimens from Aden and its neighbourhood are much paler in colour than those from the opposite African coast.

"This species is plentiful everywhere on the rocks in Aden, from the sea-level to the summit of Shum-Shum. I was at first under the impression that they basked in the hottest sunshine, but found afterwards that they almost entirely disappeared during the greatest heat of the day. Nevertheless, when they were moving about, the rocks were so hot as to be unpleasant to the touch. I also found it in considerable numbers on the trunks of large babool trees about 4 miles on the Aden side of Lahej."

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[1] Boulenger, Ann. & Mag. N. H. (5) xx. 1887, p. 407.

[2] Cat. Liz. B. M. 2nd ed. i. 1885, p. 14.

3. HEMIDACTYLUS SINAITUS, Boulenger.

Hemidactylus sinaitus, Boulenger, Cat. Liz. B. M. 2nd ed. i. 1885, p. 126.

1 ♂, 2 ♀, and 2 juv. Shaikh Othman.
1 ♀. Lahej.

This species was founded by Mr. Boulenger on a female from Mount Sinai. In it the nostril is formed by the rostral and by three nasals, the first labial being excluded from the nostril by the junction of the lowest nasal and the rostral[1]. In five of the specimens collected by Colonel Yerbury, the first labial enters the nostril by a fine point, whereas in one it enters the nostril on one side and is excluded on the other by the junction of the lowest nasal and the rostral, so that the formation of the nostril is subject to variation. In only 3 out of 24 specimens obtained by me on the African coast of the Red Sea (Suakin) does the first labial enter the nostril.

In the type of the species there are no transversely enlarged subcaudal plates. The specimen from Shaikh Othman, a ♀, agrees with it in this detail, whereas in one from Aden the subcaudals are slightly transversely enlarged, whilst, on the other hand, a male from the latter locality has a mesial line of transversely enlarged sub-caudals, a feature also present in two young specimens. It would thus appear that the definition of the species, so far as its subcaudals also are concerned, requires modification.

There are also in the type 9 upper and 8 lower labials, but in two adults from Aden and in the Shaikh Othman specimen the labials are as follows:—$\frac{8}{8}$, $\frac{9}{7}$, $\frac{11}{10}$. The dorsal tubercles of the type are considerably smaller than those of *H. turcicus*; but in three Aden specimens they are even smaller than in the former, but not more so than might be expected to occur in specimens from localities so widely apart as Aden and Mount Sinai.

In the type there is a large chin-shield on each side of the mental, in contact with its fellow behind the latter, and in relation externally with the first and second labials. Behind it is a much smaller shield with some enlarged scales posterior to it. The chin-shields of the Aden specimens follow a similar arrangement, but with slight modifications.

The number of the lamellæ under the digits and the extent of their lateral development are important characters in the species of this genus. In these details the Aden Geckoes agree broadly with *H. sinaitus*, but, as in every other character, these features are subject to variation. The following are the numbers of lamellæ on the fore and hind feet of this species as illustrated by four specimens from Aden:—

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[1] In the original description the rostral, instead of the first labial, is said not to enter the nostril, but the relation of these shields to the nostril in the type specimen is as stated above.

	Digits 1. 2. 3. 4. 5.	Digits 1. 2. 3. 4. 5.	Digits 1. 2. 3. 4. 5.	Digits 1. 2. 3. 4. 5.
Fore limb	5 6 6 6 6	5 6 6 7 6	6 6 6 7 5	5 6 6 7 7
Hind limb......	5 7 8 10 7	5 7 7 9 7	6 6 7 9 7	5 7 7 9 8

The narrower and shorter digits, the fewer lamellæ, the smaller dorsal tubercles, and the exclusion generally of the first labial from the nostril are the features that distinguish *H. sinaitus* from *H. turcicus.*

The coloration of these Aden specimens is much paler than that of the type from Mount Sinai, and in this conforms to that generally distinctive of Geckoes from arid and desert localities. The general colour is pale olive-white, many of the tubercles being dark brown and others white. There is a broad brown band from the snout to the eye prolonged backwards along the side of the neck in a paler tint. The tail is more or less spotted with brown, the spots tending to form transverse bars. Underparts white.

This is the first record of the presence of this species in Arabia proper.

Measurements[1] of 4 specimens.

Sex.	Snout to vent.	Tail.	Width of head.	Length of head.	Length of fore limb.	Length of hind limb.
♀....	52	54	9	14·5	17·5	21
♀....	42·2	44·5	7·2	12	13·5	17
♀....	40	44	12	10·6	12·9	14·2
♂....	38	45	7	11	13·2	15

"It was very plentiful under some old matting that had been thrown down in the so-called forest, or more properly garden, at Shaikh Othman. It was generally to be found under old logs and other objects lying on the ground."

4. HEMIDACTYLUS YERBURII, n. sp. (Plate XXXVI. fig. 1.)

1 ♂. Lahej.
1 ♂. Haithalhim.

Snout moderately long, exceeding the distance between the posterior border of the eye and the ear, and somewhat spatulate in form. Eye large, its long diameter equalling half the distance between its anterior border and the snout. Ear crescentic, half the diameter of the eye. Nostril formed by the rostral, labial, and 3 nasals[2]. Body covered with minute flat rounded granules with numerous large strongly trihedral tubercles intermixed and arranged in sixteen more or less longitudinal series, and the head more sparsely covered with enlarged convex granules. The granules of the head are largest between the eye and the nostril. A few enlarged tubercles on the radial portion of the fore limb, and numerous trihedral tubercles on the hind limb, with generally a few smaller tubercles at the bases of the fourth and fifth toes. On the tail the tubercles are larger than those on the body, acutely pointed and arranged in transverse series of six, each row separated from the one in front of and behind it by about 6 rows of granules. Scales on the under surface of the base of the tail small and imbricate, but a short way beyond the base the mesial scales are transversely enlarged, and further on become transverse plates. A pair of large chin-shields in contact behind the pentagonal mental and broadly in contact with the first and second lower labials; a small shield external to each chin-shield and in contact with the second and third labials, and a line of enlarged scales below the labials. Scales on the ventral surface about one fourth the size of the dorsal tubercles, cycloid and imbricate. Limbs well developed, the fore limb reaching the nostril or in advance of the snout; the hind limb falls short of the axilla. Digits well-developed, with broad lamellæ, seven to eight on the pollex, eight to ten on the second to the fourth finger, and ten or eleven on the fifth; seven or eight lamellæ on the hallux, nine to eleven on the second, third, and fourth toes, and eleven or twelve on the fifth. Tail much depressed at the base and throughout its entire length, longer than the body and head, and finely pointed. Femoral pores 12 to 15.

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[1] All measurements are in millimètres.

[2] On one side the first labial and lowest nasal are confluent.

General colour grey, with an obscure dusky band before the eye and also behind it, with or without some feeble dusky markings on the head, neck, and shoulders; faint indications of dark bands on the middle of the tail towards the tip. Underparts white, minutely spotted with livid on the sides of the belly.

Sex.	Snout to vent.	Tail.	Width of head.	Length of head.	Length of fore limb.	Length of hind limb.
♂	69	—	19·3	14·5	26·5	33
♂	67	73·5	19	14	25·5	28·9

This species is distinguished from *H. turcicus*, Linn., by the greater development of its digits, but more especially of their lamellæ, which by their breadth recall those of a *Tarentola*. The greater development of its dorsal tubercles, the flattened tail, its heavier form, greater size, and uniform coloration are all features in which it differs from that species. Its chin-shields, also, in their relations to the upper labials differ from those of *H. turcicus*.

I have much pleasure in connecting Colonel Yerbury's name with this species. He informs me that he "saw this species once in Aden about halfway up Shum-Shum. The specimen was in a crevice of the rock, but it ran rapidly up the perpendicular face of the precipice when I tried to catch it. It is fairly common inland on the trunks of trees."

5. Hemidactylus flaviviridis, Rüppell.

Hemidactylus flaviviridis, Rüppell, Neue Wirbelth. 1835, Rept. p. 18, pl. vi. fig. 2.

Hemidactylus coctæi, D. & B. Erpét. Gén. iii. 1836, p. 365.

1 ♀. Aden.

Mr. Boulenger, in 1887, pointed out[1] that *H. flaviviridis*, Rüppell, is identical with *H. coctæi*, D. & B. While in Frankfurt-on-the-Main, two years ago, I examined the type of *H. flaviviridis*, Rüppell, and arrived at the same conclusion, being unaware at the time, however, of Mr. Boulenger's identification of the two.

As Duméril and Bibron quote Rüppell's 'Neue Wirbelthiere' in their third volume, it is evident that *H. flaviviridis* must stand for this widely distributed Gecko, which was first described from a Massowah specimen.

Of late years, it has been found at Korseir[2] and at Aden[3]. Specimens exist in the British Museum from the latter locality and also from Muscat[4].

"This is the common house Gecko of Aden, Shaikh Othman, and Lahej, and is plentiful in these localities."

6. Agama sinaita, Heyden.

Agama sinaita, Heyden, Rüpp. Atlas N. Afr. Rept. 1827, p. 10, pl. 3.

1 ♂, 3 ♀. Haithalhim.

This is the first notice of the occurrence of this species at Aden, but, so long ago as 1851, it was recorded by A. Duméril from the rocks at Muscat[5]. These Aden specimens agree exactly with examples in the British Museum from Mount Sinai, whence the species was originally described.

"Plentiful in the bed of the stream at Haithalhim. The bed was dry and consisted of pebbles of various sizes and sand, with small bushes here and there, chiefly *Dipterygium glaucum*."

7. Varanus griseus, Daud.

2 ♂. Lahej.

Mr. Boulenger[6] has recorded this species from Muscat, but this is the first notice of its occurrence at Aden.

"It seems to be rare, as I met with it only on three occasions. The first example was brought to me by a man who had been placed at my disposal, for the purpose of collecting, by the Sultan of Lahej, but this solitary specimen was the beginning and ending of his services. It was obtained in the neighbourhood of the babool trees mentioned in connection with *Pristurus flavipunctatus*. The second was received from a camel-driver who said he had killed it, at the door of his house, in Al Hautah, Lahej; and the third was seen among some thick bushes at Haithalhim."

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[1] Cat. Liz. B. M. 2nd. ed. iii. p. 485.

[2] Klunzinger, Zeitsch. Gesell. f. Erd. Berlin, 1878, p. 94.

[3] Boettger, Bericht Offenb. Ver. Nat. 1892, p. 62; Matschie, SB. Gesell. nat. Fr. 1893, p. 29.

[4] Boulenger, Ann. & Mag. N. H. (5 ser.) xxi. 1887, p. 407.

[5] Cat. Méthod. Rept. 1851, p. 103.

[6] Ann. & Mag. N. H. (5 ser.) xxi. 1887, p. 407.

In this species, but more so in *Varanus niloticus*, two slight eminences are occasionally present, in both sexes, immediately before the cloacal opening, occupying the position of the præanal pores of other lizards. The true nature of these structures in *V. griseus* is best seen by studying *Varanus niloticus*.

The pores of the body-scales of that species are very minute openings requiring the aid of a hand-lens to render them visible, but in front of the cloacal opening they decidedly increase in size, and one or more of them, always in the same spot, frequently becomes enlarged and functionally active in a way perfectly distinct from any of its fellows, as from it alone exudes a yellowish-red secretion. In front of the anus a distinct swollen eminence occurs on either side of the mesial line and in the centre of this swelling is placed the enlarged pore. When the red crust of the dry secretion is removed a distinct pit remains, and in one specimen there was clear evidence of this pit being made up from secondary cup-shaped depressions, their central walls of opposition having been absorbed, so that the pit had a quadrilobate appearance. The presence of a pair of eminences in this region suggests the probability that they are glandular in nature, and that, during their functional activity, one or more scale-pores become enlarged and perform the function of excretory orifices.

I direct attention to these structures in the *Varanidæ*, as they suggest that undue importance should not be attached to the absence or presence of præanal pores in certain *Lacertilian* genera. As a further illustration of this I may mention that in the genus *Stenodactylus* two præanal pores, like those of *Ceramodactylus*, are absent or present, irrespective of sex, in the species generally known as *S. guttatus*, Cuv., but, as every herpetologist is aware, this genus has hitherto been regarded as devoid of these structures.

8. Latastia neumanni (Matschie). (Plate XXXVII. fig. 1.)

Philochortus neumanni, Matschie, SB. Ges. naturf. Fr. Berlin, 1893, p. 30.

1 ♀. Lahej.
1 ♂. Lahej.

These two specimens so perfectly agree with Herr Matschie's description of the species, that there can be no question of their correct identification. The only example obtained by Herr Oscar Neumann measured 72 millim. from the snout to the vent; whereas the larger of Col. Yerbury's specimens, which was caught in the same locality, has the head and body 81 millim. long. In the former, the tail is recorded as having been 127 millim., whereas in the latter it is 201 millim. in length. In the smaller of the above examples, with the head and body only 53 millim. long, the tail is 148 millim., *i. e.* nearly 2 centimètres longer than that of the type, which had its body and head almost 20 millim. in excess of the former. These differences in the proportion of the tail to the body and head between the type and Col. Yerbury's specimen are doubtless due, not to variation, but to the tail of the former having been renewed. In *Latastia* the renewal of the tail is not marked by any prominent line of demarcation, as occurs in many other genera of Lizards.

There are in all thirteen longitudinal bands along the body of this lizard, counting the dark band external to the ventrals. The middle of the enlarged dorsals is olive-brown with a narrow yellowish line external to it, followed by a broad blackish band, with a narrow white band external to it, succeeded by a still broader black band with a white band below it, and lastly the less well-defined black band along the external ventrals. The upper surface of the head is olive-brown, and the limbs and tail olive above, the former being more or less black-spotted. The underparts are white, with exception of the under surface of the tail which is yellowish. In the young the lineation is even more pronounced than in the adult and the black predominates, and the posterior three-fourths of the tail are yellow, passing into orange-red at the tip.

Sex.	Snout to vent.	Tail.	Length of head.	Width of head.
♀	81	201	17	10
♂	53	148	12·3	9

Sex.	Length of fore limb.	Length of hind limb.	Femoral pores.	Scales round body.
♀	28	49	16	42
♂	20·5	36	14–15	47

The question arises whether *Philochortus* is distinct from *Latastia*, leaving for the present in abeyance the broader question whether *Latastia* is worthy of generic rank apart from *Lacerta*.

The first character of the new genus is the presence of a shield separating the interparietal from the occipital. Mr. Boulenger, however, has pointed out that a shield, in the same position, is not unfrequently present in *Latastia longicaudata*, Reuss, and my specimens from Suakin verify this and show, moreover, that the area around the interparietals and the occipital is the subject of variation, as portions become separated off from the former shields. In estimating, therefore, what value is to be attached to the presence of a small shield between the interparietal and occipital, such variations as the foregoing cannot be lost sight of, as they undoubtedly minimize its importance and negative its value even as a specific character. Moreover, it is not confined to *Latastia*, as it is not unfrequent in *Lacerta*, *Eremias*, &c.

The next character of *Philochortus* is the small size of the præfrontal suture, but this can hardly be accepted as of generic import, in view of the great variability of this suture among individuals of a species in almost every genus of the *Lacertidæ*.

The presence of a small partition separating the nostril from the first labial is not peculiar to *Philochortus*, as a similar structure exists in *Latastia*, but developed to a less extent, so that from a structural point of view, in this respect, the two nostrils are generically identical.

In the former, the nostril is between two shields, but in *Lacerta* and *Eremias* the nostril is formed by two and three, and by three and four shields respectively, and in *Latastia*, as defined by Mr. Boulenger, by two and three nasals, so that *Philochortus* is embraced by it.

In all its other details *Philochortus* resembles *Latastia*, so that there are no reasons why this Aden lizard should have generic rank conferred on it.

The *Lacerta spinalis*, Peters[1], from Abyssinia is a form closely allied to *Latastia neumanni*, Matschie, with enlarged scales down the middle of its back, but nearly smooth instead of being strongly keeled. The two have the nuchal scales granular.

"The only two specimens of this lizard in the collection were taken on a camel-tract between Lahej and Shaikh Othman. It occurs on the same kind of ground as *Acanthodactylus boskianus*, and *A. cantoris*." Herr Oscar Neumann's specimen, however, was obtained at Lahej in very long grass, a circumstance that suggested the term *Philochortus* to Herr Matschie.

Since the foregoing remarks were written, Herr Neumann has visited London, and, in order that there should be no misunderstanding about the genus *Philochortus*, he wrote to Berlin for the type, and on its arrival he placed it at my disposal for comparison with Colonel Yerbury's specimens. This I have done, and with the result that the opinion I have expressed above requires in no way to be modified.

In Herr Neumann's lizard the little shield between the interparietal and the occipital is even less than in Colonel Yerbury's specimens.

The tail bears the mark of a cicatrix, which fully accounts for its shortness compared with the other Lahej specimens.

9. ACANTHODACTYLUS BOSKIANUS, Daud.

2 ♂, 9 ♀, 4 hgr., and 2 juv. Aden and Haithalhim.

These specimens belong to the coarse type of lepidosis, as is proved by the number of scales around the middle of the body excluding the ventrals. The average number is 38, whereas in the variety with fine lepidosis the number of scales generally rises above 50.

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[1] Monatsb. Berl. Ac. 1874, p. 369, pl. vii. fig. 2.

Sex.	Snout to vent.	Tail.	Scales round body.	Ventrals.	Scales between thighs.	Length of 3rd toe, inner margin.	Pores. R.	Pores. L.
♀...	71	118	36	10	17	13·8	18	17
♂...	70	160	38	10	18	11·8	20	19
♀...	70	—	38	10	17	11·3	17	17
♂...	63	138	38	10	17	11·0	24	22

"In holes in the sand among sparse vegetation."

10. ACANTHODACTYLUS CANTORI, Günther.

Acanthodactylus cantoris, Günther, Rept. Brit. Ind. 1863, p. 73.

1 ♂, 2 ♀, 2 hgr., and 6 juv. Aden.

The four rows of scales encircling the fingers, the acutely pointed snout, and the greater number of ventral shields are characters by which this species can be at once distinguished from the obtusely-snouted *A. boskianus*. In its lepidosis it is intermediate between the extremes that occur in *A. boskianus*, the scales round the body seldom falling below 45 or rising above 48. In its coloration it resembles that species.

Col. Yerbury's specimens are the first record of its occurrence at Aden.

"Among holes in the sand among sparse vegetation."

11. EREMIAS GUTTULATA, Licht.

1 ♀. Isthmus of Aden and Shaikh Othman.

"Occurs on the same kind of ground as the two species of *Acanthodactylus*, and is not unfrequently met with in dried-up jowari fields."

12. MABUIA BREVICOLLIS, Wiegm.

Euprepes pyrrhocephalus, Wiegm. Arch. f. Nat. 1837, p. 133.

Euprepes brevicollis, Wiegm. l. c. p. 133.

Euprepes perrotetii (non D. & B.), Blanford, Zool. Abyss. 1870, p. 456.

Mabuia brevicollis, Boulenger, Cat. Liz. B. M. 2nd ed. iii. 1887, p. 169.

Mabuia pulchra, Matschie, SB. Ges. naturf. Fr. Berl. 1893, p. 29.

3 ♂ & 2 ♀. Shaikh Othman.
1 juv. ♂. Haithalhim.
2 ♂. Lahej.
5 juv. removed from ♀ from Shaikh Othman.

In the British Museum there is a large Skink obtained by Mr.

Jesse in Abyssinia, referred by Mr. Blanford[1] many years ago, and again more recently[2], to *Euprepes perrotetii*, and which he suspected was the *Tiliqua burtoni*, Blyth[3], from Somali-land.

Blyth's description of *Tiliqua burtoni* is very short. He compares it to "*Tiliqua rufescens* of India," but says that it differed in having a series of large scales along the upper surface of the tail. Now the Somali-land lizard that best agrees with Blyth's species, in this respect, is *M. hildebrandti*, and not the Abyssinian and Arabian *Mabuia brevicollis*, Wiegmann. Mr. Boulenger[4] has identified Mr. Blanford's lizard as *Euprepes brevicollis*, Wiegmann[5], after having studied the type in the Berlin Museum, and also that of *E. pyrrhocephalus*, Wiegm., preserved in the same Institution, and which he considered to be identical with the former. Wiegmann states regarding *E. brevicollis*, which was from Abyssinia, "capitis totiusque corporis pholidosis eadem quæ in *pyrrhocephala*"—a statement which is of importance as he mentions that the latter had two loreals, whereas in the specimen in the British Museum there is only one loreal—a condition, however, which is in all probability due to fusion of the shields. Apart from this abnormal feature, there can be no doubt that the Abyssinian lizard is the *E. brevicollis*, Wiegm., of which a much more detailed description exists under *E. pyrrhocephalus*. The latter was obtained by Hemprich and Ehrenberg on the island of Aschik in the Red Sea, and the former, as already mentioned, was from Abyssinia. The fact that the specimen in the British Museum was from Abyssinia and that it agreed on the whole, with the exception of having a single loreal, with the structural features and more especially the coloration of *E. brevicollis*, probably led Mr. Boulenger to select the term *brevicollis* as the specific name in preference to *E. pyrrhocephalus*. The specimen that Mr. Boulenger dealt with was a female, and all the individuals from Aden of the same sex agree with Wiegmann's description of *E. brevicollis*, whereas all the males from Aden correspond to *E. pyrrhocephalus*. From a consideration of these facts, it becomes evident that Wiegmann's description of *E. pyrrhocephalus* was founded on the male and that of *E. brevicollis* on the female of the same species. The adult of *E. pyrrhocephalus* measured about 137 millim. from the snout to the vent, which is only about 8 millim. shorter than the largest male collected by Colonel Yerbury.

Herr Matschie[6] has recently redescribed this species under the name of *M. pulchra*, his two specimens having been obtained also at Lahej, or close to it. The smallest of Colonel Yerbury's specimens is practically of the same size as Herr Matschie's largest example of his *M. pulchra*, as it is 64 millim. from snout to vent, while the latter is 61 millim. It agrees exactly with his description.

[1] Geol. & Zool. of Abyssinia, 1870, p. 456.
[2] Proc. Zool. Soc. Lond. 1881, p. 469.
[3] Journ. As. Soc. Beng. xxiv. pt. 2, 1856, p. 306.
[4] Cat. Liz. B. M. iii. 1887, p. 169.
[5] Arch. f. Natur. Berl. 1837, p. 133.
[6] SB. Ges. Berl. 1893, pp. 29–30.

Mabuia brevicollis, Wiegmann.

Sex.	Snout to vent.	Tail.	Length of head.	Width of head.	Length of fore limb.	Length of hind limb.	Scales round body.	Ear-lobules.	Relation of anterior loreal to labials.	Position of post-nasal to labials.	Position of nostril to labials.	Axilla to groin.	Shoulder to anterior canthus of eye.	Locality.
♂ ...	145	180	30	25	43·7	57	32	2–2	over 2 & 3	over 1 & 2	over 1	71	40	Shaikh Othman.
♂ ...	142	160	28	20	42·5	54	32	2–3	over 2 & 3	over 1 & 2	over 1	73	40	Lahej.
♀ ...	133	153	31	22	40	48	30	2–2	....	over 1 & 2	over 1	63	40	Abyssinia.
♀[1] ...	130	133?	25	18	35	46	32	2–2	over 1 & 2	over 1	over 1	71	37	Shaikh Othman.
♂ ...	125	170?	24·5	19·2	39·6	50	32	R. 2 L. 3	over 2 & 3	over 1 & 2	over 1	66	36	Lahej.
♂ ...	120	135	27	21	38	48	31	R. 3 L. 2	over 2 & 3	over 1 & 2	over 1	59	35	Shaikh Othman.
♂ ...	117	131?	24·7	17	39	51	32	3–3	over 2 & 3	over 1 & 2	over 1	58	34	" "
♀ ...	97	159	20·7	13	31·8	41	32	R. 3 L. 2	over 2 & 3	over 1 & 2	over 1	47	28	" "
♂ ...	64	110	15	10	21	29	32	R. 3 L. 2	over 2 & 3	over 1 & 2	over 1	32	18·5	Haithalhim.
Juv....	44	64	13	8·3	16	20	32	......	....	....	....	...	....	Fœtuses from large female from Shaikh Othman.
Juv....	44	61	13	8·6	16	21	32	......	....	....	....	...	....	
Juv....	42	60	13	7	16	21	32	......	....	....	....	...	....	

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[1] Gravid with five fœtuses.

The accompanying table (p. 648) gives the relations of some of the more important head-shields and other details connected with the external features of the species. The number of scales round the body varies from 30 to 34. The smallest number is in the Abyssinian specimen in the British Museum, but whether it is distinctive of the Abyssinian individuals generally is not known, as Wiegmann did not record the number of scales round the body. Mr. Matschie's highest number is 34, but Colonel Yerbury's only reach 32.

The females are olive-brown or olive-grey, with a varying number (generally 6, occasionally 5) of dark brown longitudinal lines marked at regular intervals with enlarged dark brown spots, each generally having a white spot associated with it. Some of these lines are prolonged on to the tail. The intervals between two lines generally contain two scales, rarely three. The shields of the head are margined with dark brown, and there are some obscure dusky lines on the throat. The underparts are white. The males are generally brown above, with obscure indications of darker brown bands, sometimes entirely absent, and each scale is margined with brown. The back is frequently white-spotted and also the sides of the head and neck, but these spots are variable, and in some they are all but absent. There is generally a dark black band behind the eye passing over the ear and becoming dusky along the sides. In some the top of the head is reddish brown, the sides of the head from behind the ear forwards to the snout, and invading the lower labial margin, bright brick-red spotted with white. In others these parts are all inky black, including the chin and throat, but white-spotted. In some black and white prevail on the sides of the head.

This lizard is viviparous. The female from Shaikh Othman was gravid with five fœtuses, the measurements of three of which are given in the table.

"The greater number of these lizards were caught in the traps set for rats and other small mammals in fields, gardens, and elsewhere, but a few were dug out of the ground. They seem to be vegetable feeders, the great attraction as a bait being an onion."

With reference to the food of this species, I have opened the stomachs of a number of them and have found the contents to be chiefly the remains of insects. The little vegetable matter that occurred in their stomachs was in all likelihood swallowed by the lizard in seizing its insect prey, just as *Chalcides sepoides* swallows quantities of sand.

13. Mabuia tessellata, n. sp. (Plate XXXVI. fig. 2.)

1 adult ♀.

Head moderately long, snout obtusely rounded. Nostril behind the suture of the rostral and first labial, pierced in the hinder part of a small nasal; a small postnasal resting wholly on the first labial. Supranasals linear, in contact behind the rostral. Frontonasal considerably broader than long. Præfrontals form a narrow suture before the frontal. The frontal as long as the frontoparietals and interparietals, in contact externally with the first to the third supraoculars. Four supraoculars and five supraciliaries. Frontoparietals small, forming a broadish suture before the interparietal. Interparietal narrowly separating the parietals. A pair of nuchal plates. Two loreals, the anterior resting on the second labial, and the second on the third labial and very partially on the second. A small shield, behind the second loreal, resting on the 3rd and 4th labials, and another on the 4th and 5th labials. Fifth labial below the eye, not contracted below, entering widely into the labial margin. A large transparent ocular disk, larger than the ear-opening. The ear round, with two or three small lobules at the anterior border. Thirty-four rows of scales round the middle of the body, nearly smooth, but showing faint indications of a feeble tricarination (fig. 2 *a*). Limbs well developed; the fore limb when laid forwards reaches to the anterior angle of the eye, and hind limb when stretched forwards reaches along two-thirds of the distance between the axilla and groin. The lamellæ of the digits are provided with prominent brown eminences, one to the centre of each lamella close to its distal margin, and resembling a short obtuse keel. The palmar and plantar surfaces with prominent tubercles more or less brown at the apices. Tail considerably longer than the head and body.

Head brownish above, the shields margined with dark brown; body olive, with a bluish tint on the sides, each scale margined with dark brown and producing a tessellated appearance. A few dark spots on the labials. Under surface white with a faint bluish tinge.

Sex.	Snout to vent.	Tail.	Length of head.	Width of head.	Fore limb.	Hind limb.	Scales round body.
♀....	60	80	13	8	1·9	22·5	34

This is a species allied to *M. brevicollis*, but does not reach to half its dimensions, as the type is a gravid female. It differs from it, moreover, in the arrangement of its upper labials, in the greater size of the palpebral disk, in the structure of its toes, in the number of scales round the body, and in its markedly different coloration.

14. SCINCUS HEMPRICHI, Wiegm.

Scincus hemprichii, Wiegm. Arch. f. Naturg. 1837, p. 128.

1 ♂, 1 ♀, and 1 juv. Shaikh Othman.
2 ♀. Lahej?

These specimens differ from the type in the Berlin Museum, which I have examined, in having 24, instead of 22 rows of scales round the middle of the body. In one also there are only five supraorbitals on one side of the head, whilst in the largest specimen the frontoparietals have completely united with the frontals. In other respects they perfectly agree with the type. The number of scales varies at Aden, as Professor Boettger[1], who was the first to record it from there, mentions that his specimen or specimens had only 22 rows of scales round the body.

The type of the species was obtained in Abyssinia by Hemprich and Ehrenberg.

Sex.	Snout to vent.	Tail.	Length of head.	Width of head.	Length of fore limb.	Length of hind limb.	Scales round body.	
♀...	134	72	34	26	40	41	24	Lahej, Aden.
♀...	96	52	24	15·5	31	33	24	Haithalhim.
♀...	68	37	16·5	10·7	21·4	23·5	24	Shaikh Othman.
♂...	53·5	26	15	9	17·5	18·6	24	" "
Juv.	45	32	13·4	8·2	15	16	24	" "

"Almost all the specimens obtained were dug out of the sand."

15. Chalcides (Gongylus) ocellatus, Forskål.

2 adults and 2 juv. Aden.
1 adult. Shaikh Othman.
1 adult. Lahej.

This species attains to a considerable size at Aden and its neighbourhood, but adheres to the typical form first described from Egypt by Forskål, and the number of scales round the body varies from 28 to 30. Some Aden specimens differ somewhat in coloration from Egyptian individuals, as the black and white spots are more strongly developed, the white more so than the black, and the arrangement in transverse lines is less apparent. In the intensity of the markings these Aden lizards distinctly recall those on the Berbera side of the Gulf of Aden.

Mr. Shopland, of Aden, presented a specimen of this Lizard to the British Museum some years ago.

"Very common in Aden, Shaikh Othman, and Lahej. I was at first inclined to think that a Skink seen in the stony water-courses, high up on the Shum-Shum range, was of a different species, but, although I did not get a specimen, I finally came to the conclusion that it was the same."

16. Chamæleon calcarifer, Peters.

Chamæleo calyptratus, Peters (non A. Duméril), Monat. Berl. Ac. 1854, p. 615.

Chamæleon calyptratus, A. Dum. partim, Mocquard, C. R. Philom. 1893, no. 19, p. 5.

Chamæleon calcaratus, Peters (non Merrem), Monat. Berl. Ac. 1869, p. 445.

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[1] Bericht Offenb. Ver. 1892, p. 62.

Chamæleon calcarifer, Peters, Monat. Berl. Ac. 1870, p. 110 (footnote); Reise n. Mossamb. iii. (1882) p. 22, pl. iv *a.*; Sclater, *fide* Boulenger, Proc. Zool. Soc. Lond. 1885, p. 717 et p. 833; Boulenger, Cat. Lizards B. M. iii. 1887, p. 444; Mocquard, C. R. Soc. Philom. 1895.

3 ♂ and 1 ♀. Shaikh Othman.
1 ♂. Haithalhim.

Ten years ago Colonel Yerbury presented a large chameleon to the British Museum. He captured it on a bush, on the east bank of the Toban river, beyond Isfian near Aden. Mr. Boulenger identified it as the *Chamæleon calcarifer*, Peters, founded on a chameleon which Peters had received, in November 1843, from Lieut. Barnard of H.M.S. 'Cleopatra' while the vessel was lying in the Bay of Bembatooka on the west coast of Madagascar. Peters in his description of the species gives Madagascar as its habitat. More than half a century has elapsed since Peters obtained the lizard, but although the island has been largely explored by various naturalists, and many new species of chameleons have been discovered, not a trace of this large and fine species has been forthcoming, whereas, on the other hand, chameleons presenting all the features of *C. calcarifer*, and agreeing well with Peters's figure, have been recorded from Aden. Mr. Boulenger has examined the type of *C. calcarifer* and, as has been just stated, has identified them with it. On the other hand Mr. Matschie, who has also received this large chameleon from Aden and who has free access to the type of *C. calcarifer* preserved in the Berlin Museum, regards it as a species distinct from *C. calcarifer* and has named it *C. arabicum*. But in arriving at this conclusion he seems to have been somewhat influenced by Peters's statement that its native country was Madagascar.

In order if possible to throw some light on the origin of Peters's chameleon, I applied to the Lords of the Admiralty for permission to examine the log of H.M.S. 'Cleopatra,' preserved in the Record Office. This was granted to me. This ship, under the command of Captain C. Wyvill, sailed from England on the 15th July, 1842, and Lieut. F. L. Barnard, Professor Peters's friend, is mentioned in the log as accompanying the ship. The 'Cleopatra' went to the Cape and was engaged in cruising along the coast of Africa from Natal to Zanzibar, the latter port being the furthest northern point the vessel reached. The ship was frequently at Quillimane and at Mozambique, and appears to have been engaged, among other duties, in suppressing the Slave trade. On the 24th Sept., 1843, it was off Zanzibar, and left it on the 10th October of the same year, returning by Mohilla, Johanna, to Fort St. Sebastian, Mozambique, where the vessel arrived on the 26th October. On the following day it again sailed, and in the log the entry is "running for Bembatooka Bay." It anchored off Majunga on the 30th Oct., and on the 1st November the boats were sent ashore for bullocks and vegetables. The day following, its course was directed to Nossi Bé, at the north-western end of Madagascar.

As this chameleon belongs to a section of the genus not known to occur in Madagascar, it is possible that Lieut. Barnard may have obtained it either at Mozambique or more probably at Zanzibar. To the latter port it might have been carried in a native dhow, either from Aden, or from Makulla, in the Hadramut, in which latter Sultanate the species is quite as common as at Aden, judging from the number of fine specimens brought back by my collector.

It does not seem, in view of Peters's description and figure of *C. calcarifer*, that Herr Matschie has satisfactorily established the specific distinctness of the Aden chameleon, and, until more convincing evidence is adduced, I adhere to the view first expressed by Mr. Boulenger.

In Colonel Yerbury's specimens there is great variation in the form of the casque, as it is anteriorly convex in some, while the mesial ridge in others is perfectly flat and directed backwards. There are various modifications of these two extremes. The scales of the body are all more or less conical as described by Mr. Matschie, but the degree to which this exists depends a good deal on the strength of the spirit in which the specimens have been placed and the time they have been in spirit, at least such is the case with the Aden specimens I have examined; for the recent specimens have more definitely conical scales than those that have been long in alcohol. In the former the tubercles are crowded together hiding the fine granules, while in the latter the tubercles are apart, more or less flattened and exposing the granules. In well-preserved specimens the scales above the shoulder and for a depth of five rows below the dorsal ridge are larger than the body-scales generally, and perfectly flat.

The occipital lobes, as in *C. vulgaris*, are the subject of considerable variation in the form of their outline, being much more roundly convex in some than in others. Their free margin is covered with conical tubercles, but they vary considerably in size and in their degree of convexity.

Sex.	Snout to end of casque.	Angle of mouth to summit of casque.	Snout to vent.	Vent to tip of tail.	
♂ ...	75	53	215	215	Huswah, near Aden.
♂ ...	62	50	200	224	Aden.
♀ ...	72	51	198	193	Aden.
♂ ...	65	47	196	200	Toban River, Isfian, near Aden.
♂ ...	62	46	174	190	Haithalhim.

"This chameleon is plentiful inland and may be found on any fairly large bush. In 1884, I found at Huswah, in a small bush of

Dipterygium glaucum, a small purple chameleon about four inches long. Although I kept a sharp look out for a specimen during my recent visit to Aden, I failed to obtain one, but I saw one in the possession of two Frenchmen who visited Lahej when I was there. It may be the young of *C. calcarifer* or possibly another species, but I am disposed to think that it is the former."

OPHIDIA.

17. ZAMENIS RHODORHACHIS, Jan[1].

Zamenis rhodorhachis, Jan, Boulenger, Cat. Snakes B. M. i. 1894, p. 398.

1 ♀ and 3 juv. Aden.

Sex.	Snout to vent.	Tail.	Ventrals.	Anals.	Caudals.	Scales.	Upper labials.	Labials entering orbit.
♀ ...	786	......	221	1/1	......	19	9+9	5&6
Juv.	385	155	226	1/1	133	19	9+9	5&6
Juv.	310	120	222	1/1	128	19	9+9	5&6

Sex.	Sub-oculars.	Præ-oculars.	Relation of præoculars and frontal.	Post-oculars.	Temporals.	Nasals.	Loreals.
♀ ...	1	1	B. C.[2]	2	2+3	2	1
Juv.	1	1	B. C.	2	2+3	2	1
Juv.	1	1	B. C.	2	R. 2+2 L. 2+3	2	1

The variation in the number of the ventrals of this species is very great, ranging from 213 to 262. The highest number occurs in Egypt and in Midian, and in the former country no specimen has yet been found with a lower number of ventrals than 248. In Eastern and South-eastern Arabia, Muscat to Aden, the ventrals range from 220 to 239, while, on the other hand, from Bushire to Baluchistan (Kalagan) these numbers fall very low, the range being from 214 to 218. In the Būgti hills, on the right bank of the Indus, to the north of Jacobabad, and in North-western India,

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[1] I am indebted to the Trustees of the Indian Museum for the opportunity of re-examining the types of *Z. ladacensis*. They are unquestionably identical with Jan's *Z. rhodorhachis*. At the time I described the species, Jan's work was not in the Library of the Indian Museum, Calcutta.

[2] B. C. signifies "broadly in contact"; C. "contact"; and N. C. "not in contact."

Gilgit, and Ladak the numbers vary from 225 to 246, and in Transcaspia the variation is about the same. These facts would seem to indicate that certain geographical areas are characterized by variation more or less restricted within numerical limits distinctive of each area.

"This I believe to be the commonest snake found in Aden. I had several specimens given me from various sources."

18. PSAMMOPHIS LACRYMANS, Reuss.

? *Coluber schokari*, Forskâl, Descr. An. &c. 1775, p. viii et p. 14.

Coluber lacrymans, Reuss, Mus. Senck. ii. 1834, p. 139.

Psammophis punctatus, D. & B. Erpét. Gén. vii. 1854, p. 896, Atlas, pl. 77. fig. 2, skull.

Psammophis sibilans, var. *hierosolimitana*, Jan, Icon. Gén. livr. 34, Mars 1870, pl. iii. fig. 2.

Psammophis sibilans, var. *quadrilineata*, Jan, *op. cit.* livr. 34, fig. 1.

1 ♂. Haithalhim.
1 ♀. Shaikh Othman.

Sex.	Snout to vent.	Tail.	Ventrals.	Anals.	Caudals.	Scales.	Upper labials.	Labials entering orbit.
♂ ...	813	255	178	1/1	......	17	9	5&6
♀ ...	707	437	168	1/1	149	17	9	5&6

Sex.	Sub-oculars.	Præ-oculars.	Relation of præoculars and frontal.	Post-oculars.	Temporals.	Nasals.	Loreals.
♂ ...	0	1	C.	2	2+3	2	1
♀ ...	0	1	B. C.	2	2+3	2	1

The tail of the male is imperfect, but the injured extremity has become covered by a remarkably ungulate-like scale, forming a sheath to the tip, and keeled on its upper surface.

On the right side of the male the first nasal is nearly wholly confluent with the rostral, an abnormality I have never before observed in any serpent, and Mr. Boulenger, in his wide experience, has never met with it. This specimen belongs to the variety which is uniformly coloured brownish olive, with generally a dark spot on each scale, the under surface being finely punctulated with blackish and reddish, most pronounced along the mesial area of the ventrals, with a black spot generally on the angle of each.

The second specimen belongs to the lineated variety.

This is the first record of the occurrence of this species in the Aden district.

"Appears to be fairly common inland."

19. CŒLOPELTIS MOILENSIS, Reuss.

Coluber moilensis, Reuss, Mus. Senck. i. 1834, p. 142, pl. vii. fig. 1 *a* & *b*.
Cœlopeltis producta, Gervais, Ac. Sc. et Lettres de Montpellier, iii. 1857, p. 512, pl. v. fig. 3.
Rhagerhis producta, Peters, Monat. Berl. Ac. 1862, p. 275.

Sex.	Snout to vent.	Tail.	Ventrals.	Anals.	Caudals.	Scales.	Upper labials.	Labials entering orbit.
♀ ..	610	139	176	1/1	53	17	8	4 & 5

Sex.	Sub-oculars.	Præ-oculars	Relation of præocular and frontal.	Post-oculars.	Temporals.	Nasal.	Loreal.
♀ ..	0	1	B. Ex.[1]	3+3	2+3	1	1

Recorded for the first time. The coloration is of the usual type met with on the African coast.

"This specimen was given me by Captain Nurse, 13th Bombay Native Infantry. It was killed by one of the sepoys of the regiment when returning from field-firing."

20. TARBOPHIS GUENTHERI, n. sp. (Plate XXXVI. fig. 3.)

Dipsas obtusa, Boulenger, Ann. & Mag. N. H. (5 ser.) xx. 1887, p. 407.

1 ♂, 1 ♀. Lahej.

Snout not so broad or rounded at the point as in *Tarbophis obtusus*, and less broad than in *T. rhinopoma*[2], but truncated as in the latter species. The rostral is much broader than in *T. obtusus*, and more rounded in its upper outline, and in this latter respect it more resembles *T. rhinopoma* than *T. obtusus*. The nostril is a single plate, with a cleft below it, as in the latter species; whereas in the former the nostril is perforated in a single nasal and has no cleft. The length of the frontal equals the distance between its anterior border and the tip of the snout, while in *T. obtusus* the length of the frontal considerably exceeds that interval, whereas in *T. rhinopoma* it falls short of it. In the former the lateral margins of the frontal are slightly concave, and in the latter convex; whereas in this form this shield has very slightly concave lateral borders, and is altogether broader than in *T. obtusus*. The greatest breadth, anteriorly, of the frontal equals the length of its supraorbital suture, while in *T. obtusus* it considerably exceeds the length of that suture, whereas in *T. rhinopoma* it equals the length of both supraorbital and parietal sutures. The parietals in their proportions exceed those of *T. obtusus* and of *T. rhinopoma*, as their extreme length nearly equals that of the frontal and parietals combined, whereas, in these two species, the parietals equal the length of the frontal and one half of the præfrontal. In *T. obtusus* and *T. rhinopoma* the supraocular is excluded from contact with the præfrontal by the præocular, while in *T. guentheri* it touches the præfrontal and excludes the præocular from contact with the frontal. There are nine upper labials, but exceptionally, asymmetrically, ten; but in the other two species the number is unusually ten, and exceptionally eight, nine, or eleven. The third, fourth, and fifth, or exceptionally the fourth and fifth labials enter the orbit, whereas the fourth, fifth, and sixth in *T. obtusus*, and the third, fourth, and fifth, fourth and fifth, or the fourth, fifth, and sixth in *T. rhinopoma* enter the eye. The chin-shields are narrower and more elongated than in these two species. There are 21 scales round the body, but 23 in *T. obtusus* and *T. rhinopoma*. The anal, in this species and in *T. rhinopoma*, is invariably single, but it is always divided in *T. obtusus*. Ventrals 235–274; in *T. rhinopoma* 268–280; and in *T. obtusus* 257–272. The caudals in *T. guentheri* are 66–72; in *T. rhinopoma* 76–82; and in *T. obtusus* 66–81.

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[1] Broadly excluded.

[2] Conf. Boettger, Radde's Faun. Flor. Casp.-Geb. 1886, p. 72; Boulenger, Ann. Mus. Civ. Genoa, (2 ser.) vol. xv. (xxxv.) 30 Marzo, 1893, p. 7, et Journ. Bombay Nat. Hist. Soc., May 1895, p. 325.

The general colour is exactly as in *T. obtusus* in the majority of the specimens, but in one specimen from Muscat the body-colour is greyish with numerous narrow black markings, interrupted bands, becoming indistinct posteriorly, and separated from each other by narrow whitish interspaces or lines. The upper labials are slightly orange-yellow with blackish margins; ventrals pure white.

This species was obtained some years ago at Muscat by Dr. Jayakar, and my collector who accompanied Mr. Bent on his expedition to the Hadramaut brought back two specimens.

The invariable presence of an undivided anal and of 21 rows of scales round the body of these Eastern Arabian snakes seem to entitle them to specific rank. At the same time, if a single specimen had shown any tendency to division in the anal, or had there been any variation in the number of the body-scales, I should have hesitated to follow the course I now adopt and would have regarded them as varieties of *T. obtusus*.

To bring out the differences that exist between the three species, I append the following tables (pp. 658, 659).

I have much pleasure in connecting Dr. Günther's name with the species.

"These two specimens were obtained in a sun-dried brick wall at Lahej. They were found within a few inches of each other, and each of them had breakfasted on a sparrow. In one the bird was quite fresh, and had evidently been recently caught, while in the other it was partially digested."

21. Echis carinata, Schneider.

1 ♀. Lahej.

Snout to vent 436; tail 50. V. 159; A. 1; C. 30. Scales 28; upper labials 10. Scales round eye 17 and 18. Nasals 2.

"This, I believe, to be the only venomous snake found at Aden, where, and also inland, it is not uncommon."

Tarbophis obtusus, Reuss.

Sex.	Snout to vent.	Tail.	Ventrals.	Anal.	Caudals.	Scales.	Upper labials.	Labials entering orbit.	Præ-oculars.	Relation of præoculars and frontal.	Post-oculars.	Temporals.	Nasals	Loreal.	
♀......	840	130	263	1/1	75	23	R. 10 L. 11	R. 4, 5, 6. L. 5, 6, 7.	1	B. C.	2	2+4	2	1	Beltim.
♀......	840	125	260	1/1	70	23	10	4, 5, 6.	1	B. C.	2	2+3	2	1	Mehalla el Kobra.
Hgr.	505	80	262	1/1	77	23	10	4, 5, 6.	1	0	2	2+3	2	1	Gizeh.
Juv.	396	55	266	1/1	67	23	10	4, 5, 6.	1	C.	2	2+3	2	1	,,
,,	335	46	258	1/1	69	23	10	4, 5, 6.	1	R. C., L. 0	2	2+3	2	1	,,
,,	305	49	25	1/1	79	23	10	4, 5, 6.	1	0	2	2+3	2	1	,,
♀......	1103	161	272	1/1	72	23	10	4, 5, 6.	1	C.	2	R. 3+4 L. 3+3	2	1	Tel el Amarna.
Juv.	343	51	264	1/1	66	23	10	4, 5, 6.	1	B. C.	2	3+3	2	1	,, ,,
,,	390	56	258	1/1	70	23	10	4, 5, 6.	1	B. C.	2	R. 2+4 L. 2+3	2	1	,, ,,
,,	435	69	263	1/1	81	23	10	4, 5, 6.	1	C.	2	2+3	2	1	Assouan.
♂......	1105	170	271	1/1	75	23	10	4, 5, 6.	1	B. C.	2	2+3	2	1	Egypt.
♀......	963	140	246	1/1	72	23	10	4, 5, 6.	1	?	2	R. 2+4 L. 2+3	2	1	?

Tarbophis guentheri.

Sex.	Snout to vent.	Tail.	Ventrals.	Anal.	Caudals.	Scales.	Upper labials.	Labials entering orbit.	Præoculars.	Relation of præoculars and frontal.	Post-oculars.	Temporals.	Nasals	Loreal.	
♂	987	160	235	1	66	21	9	3, 4, 5.	1	B. Ex.	2	2+3	2	1	Shaikh Othman.
♀	851	155	240	1	71	21	R. 10 L. 9	R. 4, 5, 6. L. 3, 4, 5.	1	B. Ex.	2	2+3	2	1	
♀	850	127	274	1	67	21	9	3, 4, 5.	1	B. Ex.	2	2+2	2	1	Muscat.
♂	695	110	264	1	69	21	9	R. 4, 5. L. 3, 4, 5.	1	B. Ex.	2	2+2	2	1	"
♀	955	147	236	1	69	21	9	3, 4, 5.	1	B. Ex.	2	2+2	2	1	Hadramaut.
♀	602	101	238	1	72	21	9	R. 4, 5. L. 3, 4, 5.	1	R. C. L. 0.	2	2+2	2	1	"

Tarbophis rhinopoma, Blanford.

Sex.	Snout to vent.	Tail.	Ventrals.	Anal.	Caudals.	Scales.	Upper labials.	Labials entering orbit.	Præoculars.	Relation of præoculars and frontal.	Post-oculars.	Temporals.	Nasals	Loreal.	
♂	1018	160	268	1	77	23	10	4, 5, 6.	1	B. C.	2	R. 2+3 L. 2+5	1	1 E. 0	Karman, Persia.
Juv.	421	75	280	1	82	23	9	4, 5, 6.	1	B. C.	2	R. 3+4 L. 2+5		1 E. 0	" "

BATRACHIA.

1. Rana cyanophlyctis, Schneider. (Plate XXXVII. fig. 2.)

1 ♂, 11 ♀, and 1 tadpole. Haithalhim.

Eleven years ago Mr. Boulenger[1] pointed out the identity of *Rana ehrenbergi*, Peters[2], with the common Indian species, *Rana cyanophlyctis*. I have compared Colonel Yerbury's specimens with some excellently preserved examples of *Rana cyanophlyctis* collected quite recently by Lieut. Stanley Flower at Benares, and presented by him to the British Museum, and I am fully convinced of the correctness of Mr. Boulenger's identification.

The Aden specimens are slightly larger than any examples of the species preserved in the British Museum, but Colonel Yerbury informs me that his largest specimens were specially selected on account of their size.

As the tadpole of this species has never been described, I take this opportunity to do so, as I am fortunately in the possession of a number of well-preserved specimens obtained by my collector at Hadramaut. I have followed the method of description adopted by Mr. Boulenger in his paper[3] on the tadpoles of European frogs and toads.

The length of the body is about three fifths the length of the tail, and its breadth three fifths of its length. The distance between the nostrils is about one half their distance from the extremity of the snout, and they are placed nearer to the eyes than to the snout, their distance from the eye about equalling the interorbital breadth. The eyes are on the upper surface of the head, and their anterior border is distant from the snout the length of the interval between their lower border and the spiraculum. The distance between them is slightly less than that between the nostrils and the snout and is about twice as broad as the mouth. The anterior border of the spiraculum is about equally distant from the snout and from the insertion of the limbs, and the opening is directed backwards and upwards, and is more visible from below than from above. The anus is directed to the right. The tail is about three times as long as it is deep and ends in an obtusely pointed tip. The upper caudal crest is very deep and convex, and twice as deep as the lower crest. It is prolonged on to the back to the vertical of the spiraculum, and at its anterior extremity a fold passes to each eye. The body portion of the crest generally lies recumbent in the dorsal furrow. The depth of the muscular portion of the base of the tail is about one half the greatest length of the organ.

The beak is entirely black and is strongly hooked, the upper portion broadly overlapping the much hooked lower segment. A single marginal upper line of teeth, and two lower lines of teeth, the most internal of the latter being slightly larger than the external. On the mucous membrane inside the internal row of lower teeth there is a horny black area parallel to it, but interrupted in the mesial line. A more or less double papillary fold begins immediately above the angle of the mouth and curves downwards and forwards to near the mesial line of the lower lip, where it becomes interrupted, the folds of the two sides being separated from one another by a non-papillary interspace. The papillæ are arranged on the margins of the fold, and those near the mesial line of the mouth are generally the longest.

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[1] Cat. Batr. Grad. 1884, p. 110.

[2] Monat. Berl. Ac. 1863, p. 79; Matschie, SB. Ges. naturf. Fr. 1893, p. 31.

[3] Proc. Zool. Soc. Lond. 1891.

The muciferous crypts cannot be traced, but the lachrymal gland is well developed.

The upper surface of the body is pale yellowish olive and somewhat leaden coloured on the sides and is finely spotted with black. The sides of the tail are pale greyish yellow, covered with large black spots, sparse proximally, but numerous distally and invading the crests. The upper surface of the limbs is yellowish olive spotted with black. The under surface yellowish white, with obscure small black spots on the sides of the belly and of the throat.

Measurements of largest tadpole:—Total length 107; length of body 40; width of body 27?; length of tail 67; depth of tail 24.

Length of largest mature female :—Snout to vent 97.

These specimens agree exactly with tadpoles of *R. cyanophlyctis* from Ceylon. In the latter the horny-like line within the mouth is not so markedly developed as in the Aden larvæ.

In the European species of the genus *Rana* the upper teeth are never less than in two lines and the lower teeth in three series, so that this Asiatic form differs very materially in possessing only one row above and two below. In the tadpoles of European frogs of the genus *Rana* the buccal papillary fold is always continuous round the lower lip, whereas, as has been shown, it is interrupted in *Rana cyanophlyctis*.

The beak also is larger, stronger, and more hooked than in the European species. The extent to which the dorsal caudal crest is prolonged on to the body in the Asiatic frog more recalls the tadpole of a *Hyla* than that of a *Rana*.

Many years ago Dr. Günther[1] stated that *Rana tigrina* "when frightened jumps over the surface of the water, much the same way as it does on land," and Mr. Boulenger[2] also mentions that "it is said" to have this habit. Mr. Blanford,[3] however, has pointed out "that the species so well known by this habit in India had never been satisfactorily determined, but thought that it was *Rana cyanophlyctis*, and that probably *Rana hexadactyla* had a similar habit." I am indebted to Sir William Flower for permission to quote the following passage from a letter from his son which seems fully to establish that Mr. Blanford was right in his supposition, and that it is *Rana cyanophlyctis*, and not *R. tigrina* that has this habit. Lieut. Flower says:—"With regard to the frog *Rana cyanophlyctis* which jumps over the surface of the water .... I never saw *Rana tigrina* do so. When disturbed on the bank, it always takes a plunge into the water head foremost, and goes straight to the bottom, but *R. cyanophlyctis* jumps, alighting on the surface on all fours, and then goes on again, sometimes making a dozen leaps before it finally goes under the surface. Also it will jump out of the water in the middle of a pond, and leap along the surface in a wonderful manner, finally jumping out on the land."

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[1] Rept. of Brit. India, 1864, p. 407.

[2] Fauna of Brit. India, Rept. & Batr. 1890, p. 450.

[3] Fauna Brit. Ind., Rept. & Batr. 1890, p. 450 footnote.

Colonel Yerbury also observed the same habit in the Aden frogs, but he seems to think that it is confined to the younger individuals, as will be seen from the following note extracted from his field-book:—"These frogs were in great abundance in the bed of the stream at Haithalhim. The small ones were everywhere and were frequently seen leaping along the surface of the water in the manner so often seen in India and Ceylon. The big ones were seen hiding in the deep pools or else lying with their noses out of water among the giant reeds in six or eight inches of water. In either case they required searching for, and, when found, catching—a by no means easy matter. I never recollect seing a big fellow bound along the surface of the water, and can quite understand how such a method of progression is unsuited to their size."

2. BUFO PENTONI, Andr.

3 ♂. Lahej.
5 ♂. Haithalhim.

These specimens agree in every respect with those from Suakin on which I founded the species, except that the horny induration on the swelling of the snout is absent, and in some specimens recently collected by me at Suakin it is also wanting. It must, therefore, not be regarded as a persistent character, until more information is obtained as to its true nature.

Mr. Matschie has recorded the occurrence of *Bufo arabicus*, Rüpp., at Aden, but it is just possible that it may prove to be *B. pentoni*.

3. BUFO ANDERSONI, Boulenger. (Plate XXXVII. fig. 3.)

2 jr. and one tadpole. Lahej.

This is the first notice of the occurrence of this Toad at Aden, but Mr. Boulenger has recorded it from Muscat, and the *B. viridis*, var. *orientalis*, Werner[1], from the latter locality may possibly prove to be the same species. The following is a description of the tadpole of this Toad:—

The length of the body is about four sixths the length of the tail, and its breadth almost three fifths of its own length. The depth of the tail is about one fourth of its length. The nostrils are situated about equally distant from the snout and the eyes; and the interval between them is about one half the distance between the eye and the spiraculum, and one half the diameter of the eye more than the distance between the nostril and the eye. Eyes placed on the upper surface of the head rather widely apart, the interval between them equalling their distance from the snout and falling short of that between them and the spiraculum. The spiraculum is placed slightly anterior to the middle line of the body, and is directed straightly backwards, and is visible only from above. The anus is median in position. The tail is about four times as long as deep, and is pointed at its tip. The caudal crests are of nearly equal breadth and parallel to one another. The depth of the muscular part of the base of the tail is about one sixth the length of the organ.

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[1] Verh. zool.-bot. Ges. Wien, xlv. 1893, p. 20.

Beak with a narrow black margin along the edge of each section, the lower section much smaller than the upper and almost wholly hidden by it. Two upper rows of teeth, the innermost widely interrupted in the middle, and the outer with a slight breach of continuity, possibly due to an injury. Three unbroken rows of lower teeth. A feeble ill-defined papillary fold at the side of the mouth. Muciferous crypts not visible.

Blackish above and partly so below. Sides of tail pale greyish yellow, finely marked with black pigment, darkest along the base of the dorsal crest. In another and younger specimen the body and tail are blackish brown, and the caudal crest is yellowish with fine black-pigment spots here and there.

Measurements of tadpole:—Total length 14; tail 19; breadth of body 19; depth of tail 4·5.

This tadpole is intermediate in character between the tadpoles of *B. viridis* and *B. vulgaris*, but it more resembles the latter than the former in the shape of its caudal crests, which are, however, less developed than in *B. vulgaris*. The tail in its more pointed character differs from both, but the specimen is not in a good state of preservation.

EXPLANATION OF THE PLATES.

Plate XXXVI.

Fig. 1. *Hemidactylus yerburii* (nat. size), p. 640.
1 *a*. Under surface of fingers, enlarged.
1 *b*. „ „ „ toes „
1 *c*. Chin-shields.
1 *d*. View of upper surface of snout, enlarged.
1 *e*. Tubercles of back, enlarged.
Fig. 2. *Mabuia tessellata* (nat. size), p. 649.
2 *a*. Enlarged view of dorsal scales.
Fig. 3. *Tarbophis guentheri* (nat. size), upper view of head, p. 656.
3 *a*. Side view of head.

Plate XXXVII.

Fig. 1. *Latastia neumanni*, Matschie (nat. size), p. 643.
1 *a*. Scales of upper surface of body, enlarged view.
Fig. 2. *Rana cyanophlyctis*, Schneider; tadpole (nat. size), p. 660.
2 *a*. Mouth; enlarged.
Fig. 3. *Bufo andersoni*, Boulenger; tadpole, (nat. size), p. 662.
3 *a*. Mouth, enlarged.

7. On some Points in the Anatomy of *Nautilus pompilius*.

By J. Graham Kerr, Christ's College, Cambridge.

[Received June 17, 1895.]

(Plates XXXVIII. & XXXIX.)

I. Introduction, p. 664.
II. The Body-cavity of Nautilus, p. 664.
III. The Male Genital Ducts and Penis, p. 671.
IV. The Buccal Nervous System, p. 673.
V. The Innervation of the "Inner Inferior Lobe," p. 675.
VI. The Post-anal Papillæ and Nerves, p. 676.
VII. The Spermatophore-receiving Apparatus, p. 677.
VIII. The Morphology of the "Arms" of Cephalopods, p. 678.
IX. The Phylogenetic Relationships of the Cephalopoda, p. 683.
X. Summary of Conclusions, p. 685.
Explanation of the Plates, p. 689.

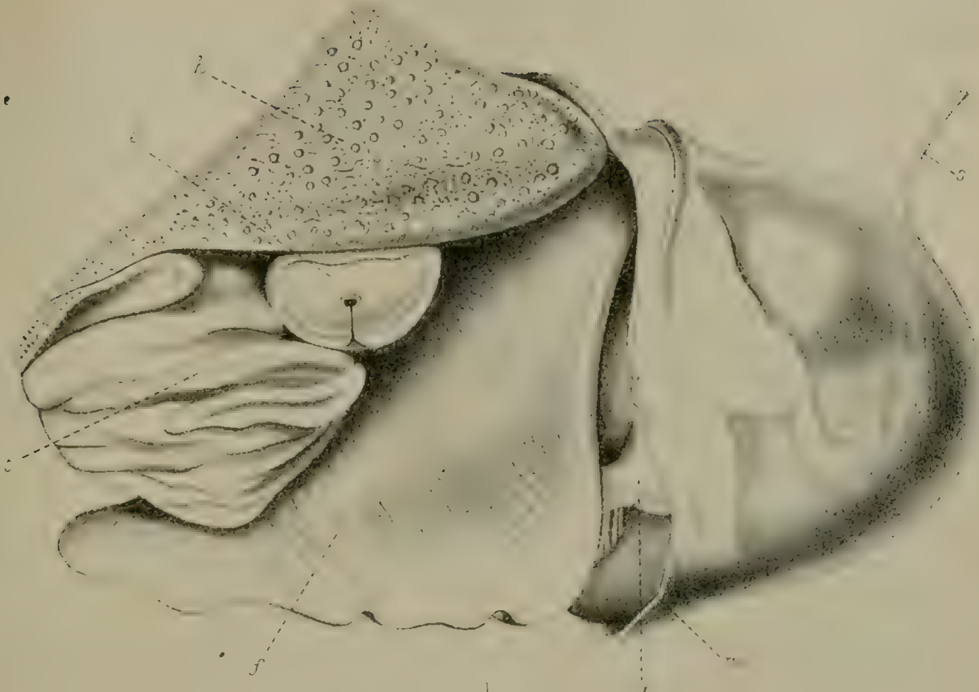
I. *Introduction.*

During the year 1893 Mr. Adam Sedgwick very generously placed at my disposal a number of specimens of *Nautilus pompilius* with the suggestion that I should make an examination of their structure. The specimens were twenty-five in number, of which, however, the great majority were very young and immature. Owing to the method of preservation and to several months' sojourn in sawdust moistened with spirit, the condition of the specimens was usually such as to render them unfit for histological study. Fortunately one of them was sufficiently good to allow the use of the section-method to confirm the results of minute dissection. In the following somewhat fragmentary paper it is my purpose to touch upon what seem to me the more important points at which I have arrived, hoping at some future date, if able to obtain properly preserved specimens, to extend my investigations and to fill up the obvious lacunæ.

I can hardly adequately express the obligation under which I am to Mr. Sedgwick for the generous gift by which he has made these investigations possible and opened the way to what, however poor its results are so far, has proved a study of absorbing interest, and also for much kind advice and encouragement. To Mr. Wilson also a word of thanks is due for the care with which he has attended to the illustrations.

II. *The Body-cavity of Nautilus.*

It is now generally recognized that the body-cavity in the *higher* Metazoa may be referred to either of two very distinct types. The first of these, typically developed in Annelida and Vertebrata, is lined by a definite characteristic epithelium, from some of whose cells arise the genital products, while others become the renal excretory cells. It appears at an early stage in development as a more or less continuous space, and it communicates with the



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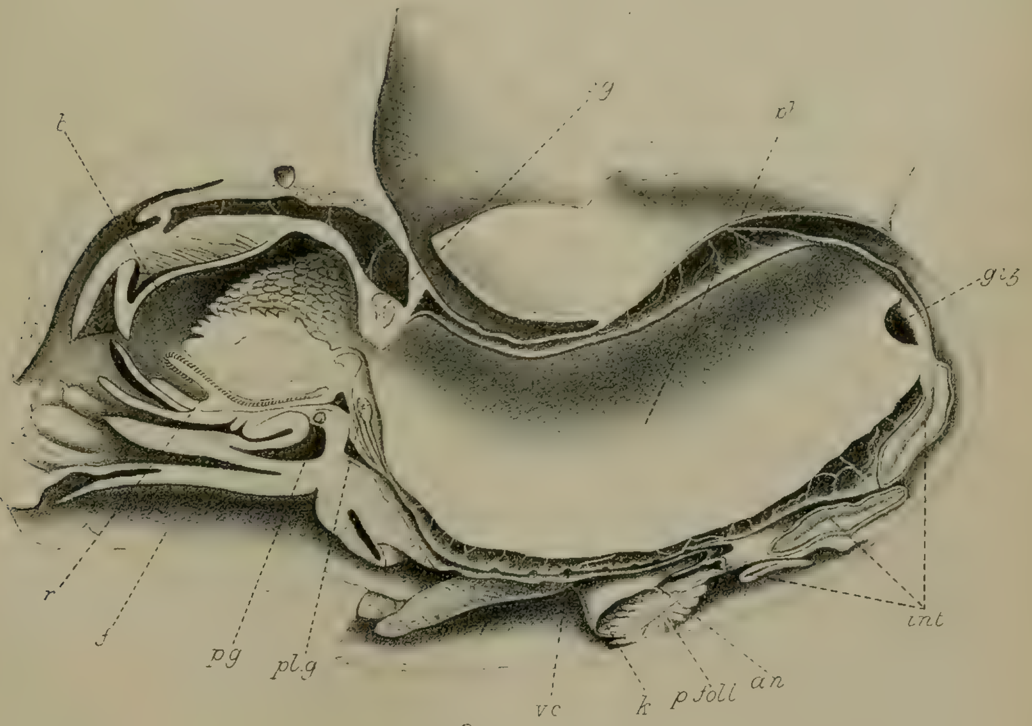

2

Edwin Wilson. Cambridge.

ANATOMY OF NAUTILUS POMPILIUS

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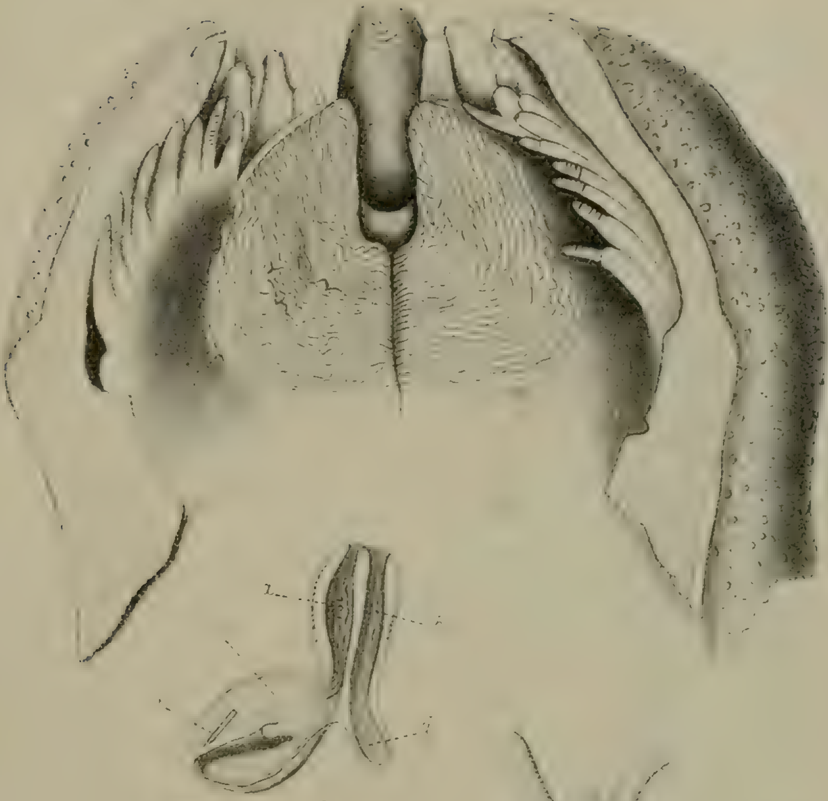

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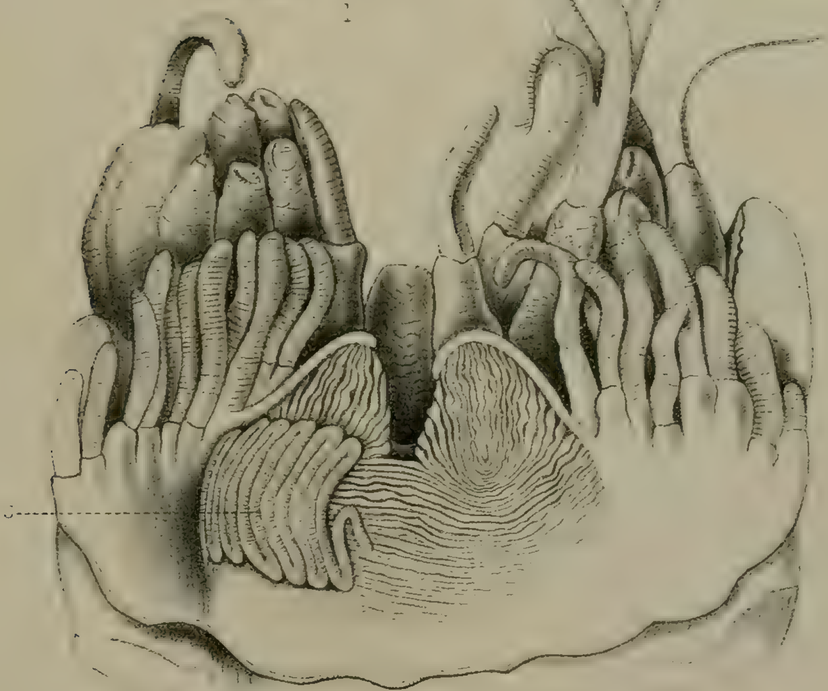

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ANATOMY OF NAUTILUS POMPILIUS

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exterior by apertures in the body-wall. To a body-cavity of this type it is advisable to restrict the term *Cœlom*.

The second type of body-cavity is to be found in the Mollusca and Arthropoda generally. It is part of the vascular system, through it is pumped a continuous stream of blood by the heart, and it does not communicate with the exterior. It may be looked on as being formed by the expansion of the terminal parts of the blood-vessels into large sinuses whose walls have, to a greater or less extent, disappeared, giving rise to a sponge-work more or less sparse according to the extent to which this process has gone on. This type of body-cavity was named by Sedgwick, *Pseudocœl*; by Lankester, *Hæmocœl*. The word cœlom has been used with such looseness that Lankester's term is perhaps to be preferred; all the more so as it specifies in itself one of the main characteristics of this form of body-cavity.

Occurring well developed in Annelids, at least allied in all probability to the ancestral forms of Molluscs and Arthropods, the cœlom is to be looked on as the more primitive of the two types of body-cavity above-mentioned; and it looks as though within each of the two latter groups it had gradually dwindled and become supplanted and replaced as the functional perivisceral cavity by the ever increasing hæmocœl.

In most Cephalopods the cœlom still takes a large part in the formation of the perivisceral cavity, and in *Nautilus*, corresponding with its more archaic character, this is so to a greater extent than in any of the other Cephalopods.

The hæmocœl of *Nautilus* is specially developed in the headward section of the body. A sagittal incision through the body-wall just behind the hood exposes to view a large chamber in which lies the pharynx as well as the vena cava, several large nerve-trunks, and a single loop of the intestine. This cavity is the main division of the hæmocœl; ventrally it is bounded by the body-wall and the muscular substance of the hood, etc., into which it extends in numerous sinuses, while dorsally and towards the apex of the visceral hump it is bounded by a thin and delicate but complete membranous septum which forms the boundary between it and the cœlom. The inner ("ventral") face of this septum has a rough and spongy appearance, and little connective-tissue strands pass from it to the surface of the pharynx. These delicate threads of connective tissue traversing the cavity and slinging up its contained organs at once suggest the hæmocœlic nature of this part of the body-cavity: and the conjecture is confirmed on raising up the pharynx, for one then sees that the upper wall of the vena cava is perforated by numerous foramina, some of considerable size, which put its cavity into free communication with that part of the body-cavity now under discussion. These foramina were described and figured long ago by Owen, in his Monograph, but they appear to have been unnoticed by subsequent observers[1].

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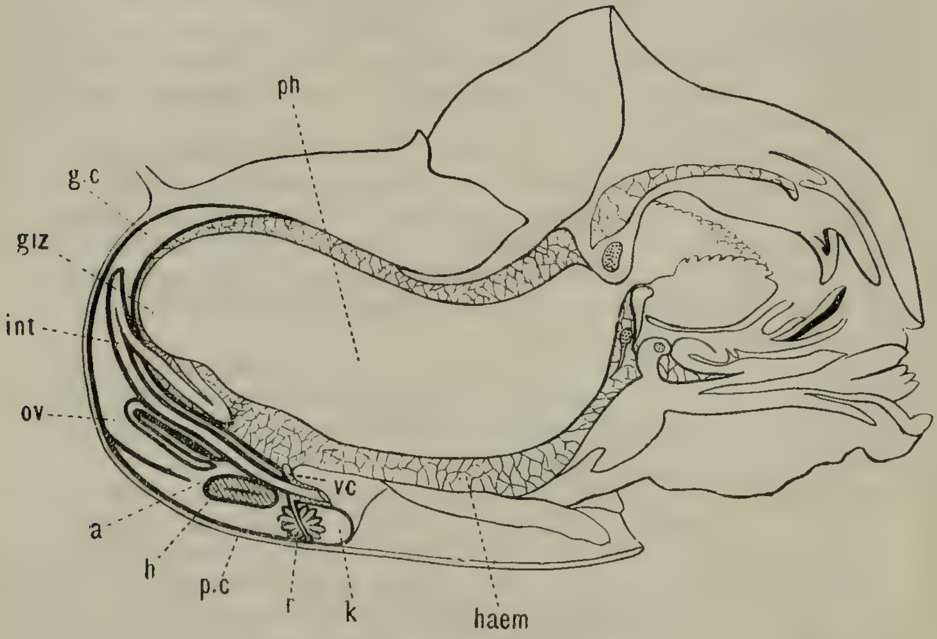
[1] Since writing the above I see that Pelseneer in his recent 'Étude des Mollusques,' p. 191, says that "la cavité viscéral est un vaste sinus communiquant avec la veine cave par des orifices percés dans la paroi de celle-ci."

The true cœlom (*viscero-pericardial sac*, Owen) has received comparatively little attention from previous investigators, Grobben and Lankester being the only authors who devote to it more than a few passing words[1].

It is convenient to treat together the cœlom itself, the excretory and the genital organs as forming all parts of the same organic complex. On reference to the diagrammatic longitudinal section through the animal, it is seen that the cœlom is limited to the aboral end of the body, where it forms a flattened space immediately underlying the body-wall—between this latter and the thin membranous bag which limits the cavity of the hæmocœl. The cœlomic

Fig. 1.



Sagittal section through *Nautilus.*

Diagrammatic sagittal section through the animal of a young female of *Nautilus pompilius*, to show the general relations of the cœlom and hæmocœl. (The section really passes very slightly to the right of the mesial plane, so as to traverse one of the renal chambers.)

haem, hæmocœl; *g.c*, genital division of the cœlom; *p.c*, pericardial division of the cœlom; *a*, aperture in septum dividing *g.c* from *p.c*; *k*, right inner kidney-chamber; *r*, pericardial gland corresponding to this kidney-sac; *h*, ventricle; *ov*, ovary; *ph*, crop; *giz*, position of its opening into the gizzard, which lies to the left of the plane of section; *int*, intestine; *v.c*, vena cava.

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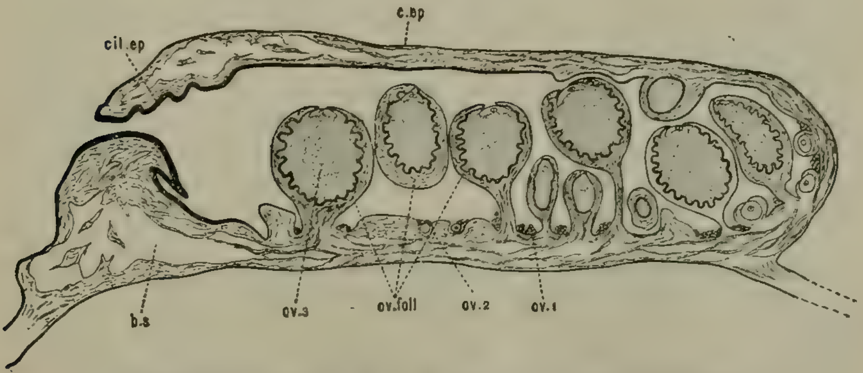
[1] Pelseneer, *op. cit.* p. 192, says that the cœlom "s'étend dorsalement, autour de l'estomac, jusque vers la moitie de l'œsophage. Il contient, outre la cœur, la glande génitale, la veine cave et un partie des appendices glandulaires des vaisseaux branchiaux afférents,"—a statement which is obviously at variance with the account here given in two important respects.

cavity is divided by an oblique septum into a large upper division (*g.c.*), the genital division of the cœlom, and a smaller lower pericardium (*p.c.*). The septum separating these is not quite complete, being perforated by three apertures of considerable size. One of these is indicated in the diagram at *a.*

The Genital division of the Cœlom (*g.c.*) is, as already mentioned, the larger of the two cœlomic chambers. It occupies the extreme aboral (dorsal) end of the body, and is lined throughout by a delicate epithelium composed of flattened plate-like cells usually hexagonal in outline, the cell-boundaries, however, being very indistinct. Each cell contains a rounded nucleus with chromatin network and one or two small nucleoli. Into this division of the cœlom project the gizzard, the greater part of the length of the intestine, and the genital gland. It must of course be remembered that all these organs are invested by the cœlomic epithelium, so that it is only in a certain sense that they can be said to be situated *within* the cavity. The genital gland being merely a specialized part of the wall of the cœlom, it may appropriately be shortly described at this point.

The Ovary is a flattened ellipsoidal body attached by a mesovarium to the lower (posterior) side of the intestine, and at its oral (ventral) end having a considerable aperture which throws its cavity into continuity with that of the surrounding cœlom. The general characters of the ovary are shown in fig. 2, representing a sagittal section through the organ of an immature female. The ovary exists here in almost its simplest possible condition, in the form of a specialized ovigerous area of the cœlomic epithelium roofed over and protected by a simple upgrowth from the cœlomic wall. The outer surface of the organ is covered over by the general epithelium

Fig. 2.



Longitudinal section through ovary of a young *Nautilus.*

c.ep, cœlomic epithelium covering outer surface of the ovary; *cil.ep*, ditto reflected into aperture of ovary; *ov.foll*, ovarian follicles; *ov.*1, 2, 3, ova in various stages of development; *b.s*, blood-sinuses in the wall of the organ.

of the cœlom, having the characters already mentioned, and at the opening at the oral (ventral) end of the ovary this is inflected into its interior so as to line this likewise. The cavity of the ovary is thus merely an incompletely shut-off portion of the cœlom. Traced into the interior of the ovary, the epithelium about its opening assumes a columnar form and bears long cilia (*cil.ep.*). Along its roof the cells become shorter and eventually cubical. About two-thirds of the way from the mouth of the cavity the ovigerous region is reached, and this occupies the remainder of the roof and nearly the whole of the floor of the ovary. The ovigerous region of the cavity is thickly beset with egg-follicles of various ages (*ov.foll.*). In the recesses between the bases of these the lining epithelium—a thin protoplasmic layer with scattered nuclei and indistinct division into cells—thickens up into syncytial masses of protoplasm containing large round nuclei, each with a large deeply staining nucleolus, around which the protoplasm tends to segregate off more or less distinctly. The primitive ovum develops within such a heap, the nucleus increasing in size and assuming more and more the character of a "germinal vesicle," and the protoplasm first becoming more distinctly aggregated round the nucleus and marked off from the surrounding protoplasm and then increasing rapidly in size. As the ovum increases in size the substance of the ovarian wall grows up round it to form the follicle, while the syncytium accompanying the ovum apparently gives rise to the lining-cells of the follicle. The latter are pear-shaped structures borne on stalks, which are usually simple, but occasionally branch, thus showing a tendency towards the condition in *Argonauta*, where they are much branched and tree-like. Externally the follicle is covered by a very thin epithelium, which distally becomes continuous with the lining layer of "follicle-cells"—a layer of thick columnar cells immediately surrounding the egg. In the young follicle this layer runs concentrically with the outer surface of the epithelium, but as the egg increases in bulk an increase in the surface of this apparently nutritive organ becomes necessary and the follicle-epithelium grows inwards as a series of anastomosing folds. On this account the older eggs when removed from the follicle show on their surface a network of deep fissures formed by the follicular epithelial ingrowths. In the oldest female specimen accessible, unfortunately too macerated to make out many details, the eggs had reached a large size, over 10 mm. in length, and their substance was already enormously yolk-laden, the protoplasm being practically restricted to a small cap on the end of the egg next the follicular opening. Imbedded in this was the large nucleus with densely staining nucleolus. The presence of a definite opening in at least the older follicles and the position of the egg-nucleus close to this, suggest the possibility of fertilization in *Nautilus* being internal; and the great size of the eggs and their yolk-laden character point to the segmentation being meroblastic as in other Cephalopoda.

The wall of the ovary, as of other important organs, is loose and spongy, traversed by extensive blood-sinuses (*b.s.*). Prolongations of these pass up the stalks of the follicles, and form a specially developed layer immediately underlying the follicle-epithelium—a condition to be correlated with the provision of an abundant blood-supply to satisfy the needs of the glandular epithelium.

The Testis is, in its main morphological features, quite similar to the ovary; in other words, it is an invaginated area of the lining of the cœlom. Only in the testis great increase in the area of the germinal epithelium has been brought about by the involuted portion of cœlomic epithelium, instead of remaining a simple sac, becoming divided up into a system of delicate branched tubes.

In an apparently adult specimen, the testis was a large brownish organ of roughly triangular shape, its rounded apex directed upwards and towards the right side. Its apical portion was in close contact with the body-wall, while its basal part was separated from the body-wall by the pericardium.

The testis is slung up by a strong ligamentous band about 1 cm. broad to the tunic of the gizzard, by a similar but broader band which is attached along a sagittal line to the body-wall (the root of the siphuncle being about the middle of its line of attachment), and finally along its anterior face by a thin peritoneal fold to the loop of the intestine. Further, at its lower end the epithelium covering the outer surface of the testis is continued into that covering the pericardial septum and heart. Near the inferior angle of the organ is its aperture—a slit about 2 mm. in length, bounded by two flat, much projecting lips, which, lying closely opposed to one another, project into a deep recess covered by a crescentic flap, the internal opening of the vas deferens. Thus, though the cavities of the testis and of the vas deferens open quite independently into the cœlom, they are at least during sexual maturity *functionally* continuous with one another.

In a section through the testis of a young individual, the aperture of the organ is seen to lead into a vestibule into which open several straight ducts. Each of these, traced inwards, divides up into numerous tubules which end blindly and are aggregated into distinct lobes and lobules. Vestibule and tubes are lined by epithelium continuous with that of the general cœlom. The wall of the organ is traversed by a sponge-work of blood-sinuses. Between the lobules these are greatly developed, their separation walls being reduced to fine connective tissue-threads serving to bind the lobes together. Into the substance of the lobules also pass continuations of the sinuses. Regarding the character of the epithelium in different parts of the tubes, the state of the specimens does not allow me to say anything.

The Pericardium or inferior chamber of the cœlom is considerably smaller than that already described. It immediately underlies the "postero-dorsal" body-wall throughout its half next the mantle-flap, and its cavity is conveniently exposed by reflection of its external wall. It is then seen to be quadrangular in outline, rather broader than long (68 mm. × 54 mm. in one specimen). From its inner (anterior) wall, in a curved row parallel to the ventral (oral) border of the chamber, project the four clusters of pericardial gland-follicles. The external pair are in such a view (*i. e.*, from posterior) partially hidden by a broad frænum, which on each side connects the anterior wall of the chamber with the posterior wall. Dorsal (aboral) to the two central pericardial glands is seen the ventricle firmly bound down to the anterior wall of the chamber—the epithelium lining which is reflected over its surface. Just dorsal to the ventricle a large rounded aperture leads into the genital division of the cœlom, and ventral to it is a still larger such opening. The four auricles attached to the corners of the ventricle, unlike it, hang quite free in the pericardium. In some specimens these were markedly asymmetrical, those of the left side being much more dilated than those of the right.

Each of the divisions of the cœlom above described is in open communication with the exterior. In the case of the pericardium, one finds at its ventral end that the cavity is prolonged on either side on the anterior face of the frænum mentioned. Each such prolongation forms a small somewhat triangular chamber with its greatest diameter transverse, and this at its mesiad end opens into the mantle-cavity by the tumid lipped, so-called viscero-pericardial aperture. The genital division of the cœlom primitively possesses at its ventral end also a communication upon each side with the exterior. In the actual animal, however, one of these has become closed internally, as Lankester has shown, while the other persists in the female as the oviduct, in the male probably as the part of the functional genital duct extending from its cœlomic opening to the inner end of Needham's sac.

On pulling the mantle dorsalwards, so as to afford a view of the interior of the mantle-cavity, such as that shown in Lankester and Bourne's figure, one notices a little distance to the headward side of the root of each gill one of the four kidney-openings. These are arranged in two pairs. Just to the mesiad side of each of the posterior openings, one sees the slit-like viscero-pericardial apertures, leading, as above mentioned, into the pericardium.

This condition in *Nautilus*, where the viscero-pericardial sac opens independently of the kidney, is homologized, and no doubt rightly so, with the condition met with in *Spirula* and Ægopsids, where the viscero-pericardial canal opens into the kidney-sac near its mouth, by supposing the opening of the latter to have migrated on to the outer surface (Grobben, Lankester), an identical process to that which has taken place in, *e. g.*, the genito-urinary passage and the rectum in Mammals.

Accompanying the anterior kidney openings no such pericardio-visceral pores are seen, and in consequence of this it has been concluded that the anterior and posterior kidney-sacs are not serially homologous. All agree in regarding the posterior one as primitive, but the anterior sac is looked on as a secondary formation—either as a secondarily arising repetition of the posterior one, or as having been split off from it in correlation with the development of a new gill and new afferent vessel (Grobben).

As a matter of fact, however, such a viscero-pericardial aperture *is* present, corresponding to the anterior kidney-opening. It is the primitive genital aperture. Such is seen either in the case of the oviduct or of the rudimentary left genital duct of either sex[1]. This opening leads into the genital division of the cœlom just as does the viscero-pericardial pore into the pericardium, and, like it, is situated mesiad to the kidney-opening. The only striking difference is, that this pore is normally rather farther apart from its corresponding kidney-opening than is the viscero-pericardial pore. The latter is normally quite close to its kidney-opening, but its distance from it is very variable and may reach 3 mm.

It appears to me that there can be no question as to the homology of the two sets of apertures. In the genital segment, however, the migration of the cœlomic aperture has gone a little further beyond the bounds of the kidney-sac. Each cœlomic duct, plus its kidney-sac, would on this view correspond to an ordinary "nephridium," *i. e.*, a tube leading from the cœlom to the exterior, part of the wall of which has taken on an excretory function. In the Dibranchs, in correlation with the disappearance of the anterior gill, the corresponding kidney-sac has disappeared, while its cœlomic duct persists as the genital duct. The genital ducts of the Cephalopoda in general then are nephridia[2], minus their excretory sacs.

III. *The Male Genital Ducts and Penis.*

The general disposition of the genital apparatus in the male is shown in fig. 3 (p. 672). As is well known, only the duct of the right side is functional in *Nautilus*. On the left side there is the "pyriform sac" of Owen, shown by Lankester and Bourne to represent the left genital duct, although the question was left open by them—whether it represented *only* the genital duct, or the genital duct together with the genital gland of the same side[3].

From the large cœlomic aperture the genital duct passes through the quadrangular "accessory gland" composed of numerous cæcal tubular outgrowths from the duct itself. Beyond this point the duct opens into the spermatophore sac—a large structure somewhat elliptical in outline when seen from the anterior (dorsal) or posterior (ventral) aspect (Pl. XXXIX. fig. 1). The vas deferens opens into this at its outer end. Internal to this opening there begins a longitudinal septum which divides the cavity of the sac through about half its length—terminating in a free concave edge.

[1] In the case of the functional genital duct of the male, a shifting of the external aperture has taken place through the, in all probability, *secondary* development from the adjoining body-wall of the penis.

[2] Pelseneer asserts that the genital ducts of Cephalopods are nephridia—without, however, qualifying his statement or supporting it by evidence.

[3] That it represents only the duct appears to me to be shown by the condition in the very young animal, in which the inner part of the genital duct has exactly the appearance of the pyriform sac in the adult—the rudiment of the gonad being quite distinct and apparently median and unpaired.

In the sexually mature animal the much coiled-up spermatophore mass occupies the cavity of the sac bending round the edge of the septum. The internal surface of the sac-wall is smooth to the naked eye, while a low-power lens discloses the existence of minute glandular-looking rugæ running on the whole parallel to the axis of the spermatophore mass.

At its anterior inner corner the cavity of Needham's sac passes into the penis. This is a somewhat cylindroidal, flattened structure about 10 mm. in length and 8 mm. greatest breadth, attached to the body-wall within the mantle-cavity. Its walls are thick and muscular, and its cavity is divided by a sagittal longitudinal septum, which does not extend quite to the tip of the organ, into

Fig. 3.

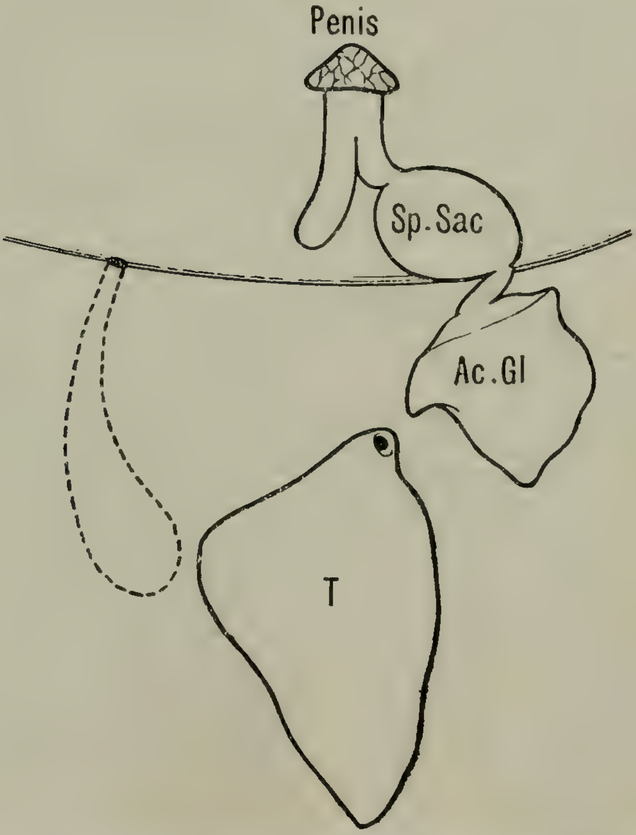


Diagram of the testis, genital duct, and penis of the male *Nautilus*. The rudimentary genital duct of the left side is dotted in.

T, testis: at its upper end is seen its aperture into the general cavity of the cœlom. Ac.Gl, accessory gland with internal opening of the vas deferens beneath the crescentic flap at its left-hand corner. Sp.Sac, spermatophore sac.

The curved line traversing the diagram from side to side represents the line along which the mantle-flap is reflected headwards.

two moieties. Of these it is only the right with which the sac of Needham communicates, the left being (as will appear later) connected merely with a peculiar blind sac. The right penial cavity is somewhat semi-pyriform, becoming narrower distally. Its lining is thrown into large smooth glandular-looking rugæ, which anastomosing with one another form a kind of raised network with elongated meshes. Outside this lining is the muscular coat about 1·5 mm. thick and largely composed of radial fibres. The muscular layer is traversed by an extensive system of blood-spaces. This is most developed towards the "posterior" end of the penis. It forms a distinct layer near the outer surface of the organ, but its spaces also, though less conspicuously, ramify hither and thither in the general substance of the muscle.

The left penial cavity is cylindroidal in form, and its diameter only about half that of the right cavity at its widest part. The inner surface of its wall is also thrown into folds; but these are mainly longitudinal, parallel, and do not anastomose to the same extent as do those of the right cavity. The lining-tissue is of a less deep colour and less glandular-looking; the muscular wall is thinner, and the cavernous layer is also less developed.

At its "posterior" end, about the level of the point at which the right cavity becomes continuous with the sac of Needham, the left cavity diverges towards the left side, much as the long axis of the Needham's sac does towards the right, and gradually expands into a flask-shaped sac, in this specimen 6 mm. long by 3 mm. broad. This is rounded off and ends blindly. The inner surface of its wall exhibits faint longitudinal corrugations. It is difficult to believe that this left moiety of the penial apparatus does not represent the reduced fellow of the right moiety, *i. e.*, of the right penial cavity plus the sac of Needham. On the left side, however, the rudimentary vas deferens does not communicate with the penial sac, but opens, as is well known, directly into the mantle-cavity. The position of this external aperture corresponds very closely to that of the opening of the vas deferens into the spermatophore sac on the opposite side. The whole arrangement strongly suggests that of the functional male genital duct, only that portion from the cœlomic aperture to its opening into the sac of Needham represents the primitive duct, and that the Needham's sac and the penis are secondarily added structures developed from the adjacent wall of the mantle-cavity. In the young animal, the Needham's sac being not yet expanded, the form and size of the right portion of the apparatus are in almost exactly the same condition as is the left in the adult.

IV. *The Buccal Nervous System.*

Lankester[1] says, in speaking of *Nautilus*:—"No buccal nervous system has been observed in *Nautilus*;" and again, "nor has an enteric nervous system been described in this animal." In regard to both these statements, Professor Lankester seems to be in error, as a complicated buccal system was described and figured by H. v. Jhering[1], while at least part of an enteric system was described by Keferstein[2]. In regard to the buccal nervous system it seems advisable to give a short account, however, as von Jhering's remarks are very brief, while in the construction of his diagram a curious blunder seems to have been made, which has been perpetuated by its being copied by leading text-books. In effect, what he figures as the cerebro-pharyngeal connective is really the forward prolongation of the pharyngeal ganglion, which, uniting with its fellow in the middle line, forms the anterior infra-buccal commissure. On the other hand, the two nerves figured as emerging from the pharyngeal ganglia laterally are the cerebro-pharyngeal connectives, of which there are not one, but two, on each side. In fact, by rotating the portion of his figure representing the buccal nervous apparatus through 180° about an axis passing through the pharyngeal ganglia and joining up the cut ends as indicated above, one gets quite an accurate diagram. No doubt v. Jhering's slip arose through dissecting and figuring this part of the nervous system after the buccal mass had been removed from its connection with the animal.

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[1] Zoological Articles, p. 142.

The cerebro-pharyngeal connectives are two thick nerve-trunks on each side, taking their origin from the adoral border of the supra-œsophageal nervous mass. Enclosed in a dense sheath of connective tissue, they pass to the sides of the buccal mass. For the first part of their extent their course is highly sinuous, a character probably to be connected with the protrusibility of the buccal mass and the consequent very variable distance between it and the fixed circum-œsophageal parts of the nervous system. Pursuing a slightly convergent course the two connectives reach the lateral aspect of the buccal mass, and there unite in the pharyngeal ganglion (fig. 4, *ph.g.*)—a triangular structure with its apex directed towards the mouth—and another of its angles external. It lies on the muscles of the buccal mass immediately beneath the skin.

The two pharyngeal ganglia are connected to one another by a longer anterior and a shorter posterior commissure, on the course of the latter being the slightly swollen "buccal ganglia." The anterior commissure (fig. 4, *ant.com.*), figured by v. Jhering as cerebro-pharyngeal connective, is a flattened band nearly 1 millimetre in breadth, and pursuing a ∩-shaped course immediately beneath the skin, and just within and parallel to the margin of the lower mandible. As the ganglion tapers off into the commissure, it gives off numerous small and several larger filaments to the skin-fold surrounding the mandibles. From the adoral part of the commissure also some very fine strands pass off to the same structures.

The internal angle of the pharyngeal ganglion is prolonged towards the middle line into the posterior commissure, which soon swells out slightly, forming the buccal ganglion (*buc.g.*). From this pass backwards two nerves into the sponge-work of the pharyngeal wall (*ph.n.*). Whether they are continued back in this along the sides of the crop to become connected with the gastric ganglion, I was not able satisfactorily to determine. From the aboral end of the buccal ganglion anteriorly a twig passes to a large elevation of the buccal lining, within which it divides up into numerous branches. At its oral end the ganglion passes into the short convex-forwards commissure which connects it with its fellow. From this two nerves pass adorally on each side, the smaller more mesially situated immediately underlying the radula.

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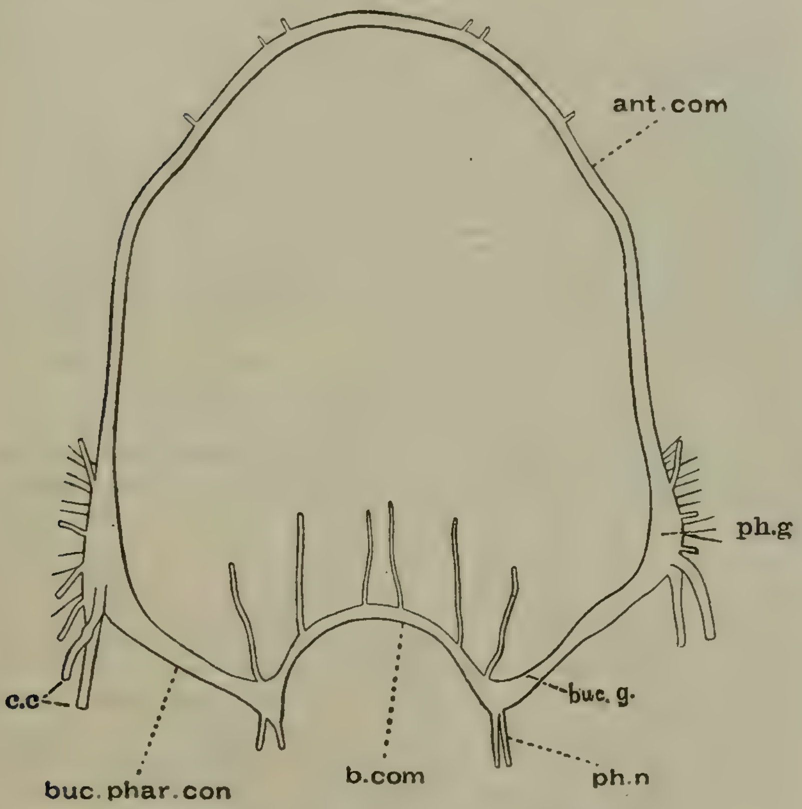
[1] Vergl. Anat. des Nervensystems der Mollusken, p. 263.

[2] Bronn's 'Thier-Reich,' Malacozoa, p. 1373.

Fig. 4.



Buccal nervous system of *Nautilus pompilius*.

ph.g, pharyngeal ganglion; *buc.g.*, buccal ganglion; *c.c*, cerebro-pharyngeal connective; *buc.phar.con*, bucco-pharyngeal connective; *ph.n*, pharyngeal nerves; *b.com*, buccal commissure; *ant.com*, anterior pharyngeal commissure.

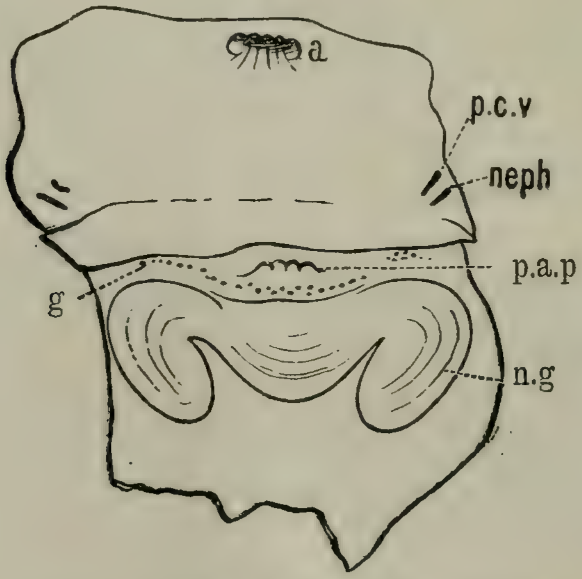
V. *The Innervation of the "Inner Inferior Lobe."*

Posterior (ventral) to the buccal mass, well within the hood-tentacle complex, is a flattened lobe, bearing on each side a series of tentacles, separated by a peculiar lamellated organ which has been supposed to be sensory. This lobe is called the "inner inferior lobe" by Lankester. For its innervation there is figured by Owen, and copied by Gegenbaur and others, a small distinct ganglion on each side. In the specimens which I have dissected, however, the conditions are as follows:—Upon each side, somewhat external to the root of the funnel-nerve, there arises from the anterior sub-œsophageal nerve-cord a rather thinner nerve-trunk, which passes into the basal part of the lobe mentioned. This bends towards the middle line, pursues a curved course in the substance of the lobe, and meets with its fellow of the opposite side. The two together form in fact not two separate ganglia, but a continuous cord. The median most strongly curved part of this cord gives off about 24 slender nerve-filaments, which radiate forwards to the lamellæ of the lamellated organ. The more lateral parts of the cord, on the other hand, give off a stout unbranched nerve to each of the tentacles of the lobe. These nerves, coursing as they do through the fibro-muscular substance of the lobe, are very hard to trace out in their entirety.

VI. *The Post-anal Papillæ and Nerves.*

A short distance behind the anus is a peculiar flap-like structure, arising from the body-wall and bearing four papillæ. It varies

Fig. 5.



Post-anal papilla with glands in the female.

a, anus; *p.a.p*, post-anal papilla; *g*, openings of glands; *n.g*, nidamental gland; *p.c.v*, pericardio-visceral aperture; *neph*, opening of kidney chamber.

much in form—sometimes being divided into two distinct halves—sometimes continuous mesially—sometimes thin and membranous—sometimes tumid and swollen. It is covered by columnar epithelium, and filled with ordinary connective tissue, sometimes with abundant jelly-like matrix.

In the female, examination of this region with a hand-lens shows the existence of a large number of apertures in the outer skin. These, to the number of about 150, form a band about 0·5 mm. in width, curving gently forwards on either side of the post-anal papilla, tapering off and terminating close to the advehent vessel of the posterior gill. In section these openings are seen to be the apertures of tubular ducts which pass inwards perpendicular to the surface for some little distance and then break up into several blindly ending branches. These are lined by involutions of the surface epithelium, which in the neighbourhood of each aperture increases to about twice its thickness elsewhere, its cilia at the same time becoming extremely long and powerful (·03 mm. in length). Once within the narrow aperture the lumen of the tube expands to about ·05 mm. in diameter, and the lining epithelium becomes shorter, the remainder of the lumen being lined by comparatively short columnar cells, each with a round ellipsoidal nucleus.

Arising from the posterior side of the posterior sub-œsophageal nerve-cord, close to the middle line, are a pair of stout nerve-trunks, which pass backwards on either side of the vena cava. The greater part of these pass off to supply the gills, but a direct prolongation of each is present, which passes backwards on either side of the post-anal papilla. This nerve is largest in the female, where it gives off nerves towards the middle line, supplying the nidamental gland. In the region of the post-anal papilla branches also pass off towards the middle line. There appears to be—although the condition of the material did not allow me to quite satisfy myself on this point—an anastomosis of these centrally passing branches with those of the opposite side. If this be confirmed we have here a true post-anal commissure, such as exists in *Chiton*: in which case we should be compelled to regard not merely the "posterior sub-œsophageal nerve-mass," but rather the two lateral portions of this, together with the nerve-trunks which have been mentioned as passing backwards on either side of the vena cava, as forming the homologue of the pleuro-visceral nerve-cord of *Chiton*. The mesial part of the posterior sub-œsophageal nerve-mass would then represent a secondary fusion between the nerve-masses of the two opposite sides.

VII. *The Spermatophore-receiving Apparatus.*

Behind (ventral to) the buccal mass and immediately underlying the inner inferior lobe, the kind of shelf which connects the tentacular mass of one side with that of the other has its inner surface raised into a series of curious lamellæ.

The remarkable organ formed has been referred to by Valenciennes[1], and by Lankester[2], as a paired structure. Not always, however, does it seem to be so, as in one of the two specimens in which I observed it the laminæ were quite continuous across the middle line, the laminæ appearing in fact to be mere exaggerations of the fine transverse wrinkles into which the surface of the skin is thrown behind the lamellar organ. Of the two authors referred to, the first, after some hesitation, suggests that the lamellated organ may be tactile in function, "analogous to the palpi round the Crustacean mouth." Lankester, on the other hand, for what reasons is not stated, very definitely describes the organ as "probably olfactory."[3]

During the examination of a mature female somewhat startling evidence was obtained as to the true function of this organ. The lamellæ were here covered with a thick coagulated materi apparently secreted by them, spreading over the edges of the lamellæ and passing in thin plates down between them. Partially imbedded in the coagulum on the left side and only partially visible, there appeared a peculiar brown structure which at once suggested the appearance of a spermatophore. And upon carefully clearing away the surrounding material the surmise so suggested was corroborated. The long slender spermatophore lay coiled backwards and forwards over the surface of the lamellæ in the manner indicated in Pl. XXXIX. fig. 2, held firmly in position by the coagulated material.

We would seem to have here a peculiar cement-secreting glandular apparatus, on whose sticky surface the spermatophore is deposited by the male.

In other Cephalopods the position in which the spermatophore is attached to the female varies: in Œgopsids, Octopods, and *Sepiola, e.g.*, it is passed into the mantle-cavity; in other Decapods (*e.g.*, *Sepia*, *Loligo*) it is attached to the skin on the outer surface of the buccal mass. In *Nautilus* the position is thus a somewhat intermediate one.

VIII. *The Morphology of the "Arms" of Cephalopods.*

As Grobben has justly remarked, and as Pelseneer has adopted as text to his paper on the subject, "eine der schwierigsten Fragen in der morphologischen Deutung des Cephalopodenkörpers bildet die Morphologie der Kopfarmen"; and in accordance with this, as well as with its far-reaching interest, the question has attracted from time to time a great amount of attention from morphologists. Regarding the fundamental nature of these organs, two very different views have been brought forward:—

(1) That the arms of Cephalopods are processes of the head or circumoral region.

(2) That they are processes of the foot, part of which has grown up on either side so as to finally surround and almost completely hide from view the head itself.

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[1] Arch. Mus. d'Hist. Nat. tom. ii. p. 277.

[2] Zoological Articles, p. 130.

[3] *Op. cit.* fig. 88.

To enter in detail into the differences as to minor points in the tenets of the various upholders of these two views seems unnecessary, as this has already been done by others[1]; and further, because it is proposed to consider the problem here in its most general aspect—as to whether the Cephalopod arms are cephalic or pedal.

It may be advisable, in the first place, to inquire whether there is anything in the general relations of the parts to support or even to suggest the second of these views. In ordinary Cuttlefishes it is pretty obvious that there is nothing of the kind—the arms form a continuous circle round the buccal mass—one would naturally suppose they belong to the head. It is therefore important to glance at *Nautilus*, where, as Lankester has well accentuated, "any divergence from the condition obtaining in other forms has possibly, and even probably, a special significance," and "is not readily to be dismissed as an 'adaptation' peculiar to that form."[2]

In *Nautilus* the arrangement of the circumoral lobes and tentacles has been described by Bourne and by Lankester, so that it is unnecessary to go into details. Anteriorly (dorsally) is the large fibrous mass of tissue which forms the hood. Laterally, on each side, is an aggregation of tentacles. Anteriorly (dorsally) the mass of tentacle-sheaths is directly continuous with the hood. On slicing away the substance of the hood carefully, it is seen that the bases of all the outer tentacles are embedded in it. The appearance of tentacle-sheaths is due merely to the more or less distinct marking off by superficial grooves of the parts of the mass surrounding each tentacle. Hood and tentacle-sheaths together form a perfectly continuous mass lying anterior (dorsal) to the buccal mass and curving backwards (downwards) on either side of it in saddle-like fashion. In the male this is very obvious, the two limbs of the mass being connected together posteriorly merely by a thin shelf. In the female, however, this bears on its inner side the "inferior inner lobe," which bears on each side a group of tentacles and whose appearance suggests a bilateral origin. The main impression given by the tentacle-hood complex is that of a saddle-shaped structure, situated anterior (dorsal) to the buccal mass—its limbs passing backwards on either side of the latter. The anterior (dorsal) part of the complex here predominates: it is developed less equally all round the buccal mass than in Decapods; its preponderating part is dorsal.

The next point of interest in the gross anatomical relations of the parts lies in the funnel which, according to the upholders of the "pedal" view, is primitively continuous with the tentacle-hood mass.

The Funnel.—This is a large tongue-shaped structure attached to the posterior face of the body—to the roof of the mantle-cavity, into which it imperceptibly passes aborally. At its oral end it projects parallel to the axis of the buccal mass—quite free and separated by a deep groove from the hood and tentacle-mass. Tongue-like in form, its margins are inrolled about a longitudinal axis, so that one comes to overlap the other. Which does so appears to be quite inconstant in different individuals, and in any one individual the right and left margins present exactly the same appearance; there being nothing to point to one in particular being kept habitually folded over the other. From this, and from the general muscular character of the funnel, I have little doubt that the living animal possesses the power of unrolling and flattening it out, possibly even of using its broad lower face to creep on or adhere to rocks. In spirit-specimens one can readily so unroll the funnel, and when this is done the appearance of the animal is very striking, as is shown in Pl. XXXVIII. fig. 1, where, by the way, the mantle-flap has been partially removed so as to afford a better view of the creature. One is here impressed, first of all, by the sharp way in which the funnel is marked off from the hood-tentacle-head mass. Everywhere a deep groove separates them[1]. There is nothing here to suggest or even support the view that part of the foot has grown up round and become fused with the head. Again, the great size of the organ is very impressive—more especially its width from side to side,—and its entire condition is such as at once, to my mind irresistibly, to suggest that in this organ one has the representative of the whole of the foot of the ordinary Gasteropod.

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[1] *Cf.* especially Pelseneer's admirable summary, 'Challenger' Report Pteropoda.

[2] Quart. Journ. Micr. Science, vol. xxiii. p. 348.

The general relations of the parts in *Nautilus* impress upon one that:—

(1) The hood-tentacle complex is preponderatingly anterior (dorsal) to the buccal mass, its posterior (ventral) parts being relatively insignificant.
(2) The hood-tentacle complex is most sharply marked off from the funnel by a deep groove.
(3) The funnel is enough, in itself, to represent the whole of the Gasteropod foot.

Considering merely them alone, there is no suggestion of doubt that the hood-tentacle complex is cephalic; that the funnel is the Gasteropod foot.

It is because, at the present time, after many years of controversy, the contrary view, which for shortness may be referred to as the 'pedal' view, has gained the ascendency and has come to be the one enunciated by the most authoritative text-books[2], that the present discussion seems necessary.

When Lankester published his 'Encyclopædia Britannica' article on Mollusca, he pointed out that the view taught by Leuckart, Lovén, Huxley, and himself, that the Cephalopod arms are pedal in their nature, was based upon three different sets of evidence—to wit, those derived from

---

[1] In this connection the figure given by Lankester (Zoological Articles, fig. 91), though very corroborative of the view there advocated, seems scarcely in accord with the actual conditions.

[2] Lang's Lehrbuch, pp. 587, and Korschelt and Heider, p. 1176.

(1) Their ontogenetic development;
(2) Their innervation;
(3) Their homology with the sucker-bearing processes of the larval Pneumoderma.

Of these (3) derived its force from the supposed pedal nature of the sucker-bearing appendages. However, it has now been satisfactorily shown[1] that they are purely cephalic, and therefore this argument, if it be argument at all, tells precisely in the opposite direction. At present, therefore, the view that the Cephalopod arms are parts of the foot rests upon (1) and (2). In regard to (1), however, although it must be admitted that the facts of embryology do tend to bear up the view that the crown of arms is formed by an upgrowth from each side of the foot, it must be borne in mind how extremely unreliable any evidence, as to topographical relations, must be which is based on the phenomena exhibited in the development of enormously yolk-laden eggs. Therefore it appears that the only one of the three classes of evidence adduced above which can be considered of real weight, is that resting upon the innervatiou of the parts under consideration, and that this opinion is shared by other workers, is shown by its tendency in more recent writings to supplant the evidence derived from embryology. It appears, therefore, not inadvisable to submit this portion of the evidence to a short critical examination, to endeavour to ascertain whether it is equal to bearing the strain of acting as main support to a view which we have seen to be inherently improbable, on the evidence afforded by gross anatomical relations. And as a preliminary it may be well to look into the general ideas now held and taught by zoologists as to the general character of the Cephalopod central nervous system.

In the latest text-book of Zoology (Lang, p. 722) one reads, "Das symmetrische Nervensystem aller Cephalopoden zeichnet sich durch *die sehr starke Concentration der typischen Mollusken-ganglien*, auch derjenigen der Visceralconnective, aus;"[2] and this I think I may venture to say fairly represents the views held and taught by zoologists generally: that the Cephalopod central nervous system consists typically of three pairs of ganglia aggregated round the œsophagus, which ganglia are homologous with the three similar pairs of, say, a Gasteropod. That a certain rough resemblance does exist between the arrangement of the ganglia round the œsophagus of a Dibranchiate Cephalopod and that met with in many Gasteropods may be at once admitted; but when it comes to be a question of precisely homologizing the individual ganglia in the one case with those in the other, one has to do with a very different matter. Supposing, for a moment, the homology to hold, then one ought to find the resemblance most marked in those Cephalopods which phylogenetically most nearly approach the common ancestral forms of Gasteropods. But what are the actual anatomical facts?—that in the *Nautilus*, the most primitive and oldest Cephalopod now existent, such division into three pairs of ganglia is completely absent. And then one might turn to that Gasteropod (I here use the term in its wide sense) which other evidence points to as having similarly to the greatest extent retained such common ancestral conditions—to wit, *Chiton*. And here again one finds a complete absence of segregation of the central nervous system into its three pairs of ganglia, and in its stead a central nervous system showing in many respects a strong and fundamental resemblance to that of *Nautilus*. The facts of Anatomy, then, are strongly opposed to any rough-and-ready homologizing of the various ganglia of the higher Cephalopod with those of the higher Gasteropod. One might go so far as to say that they demonstrate their non-homology. The common ancestor of Gasteropods and Cephalopods, so far as we can see, possessed, as did and do so many other primitive forms, a nervous system consisting of thick strands ensheathed in a continuous layer of nerve-cells; and any departure from this condition, in the direction of collecting and centralizing these nerve-cells into ganglia to fulfil local requirements, is a process which has taken place independently within each of the two stems of descent.

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[1] 'Challenger' Reports: Pteropoda, Anatomy, p. 39.

[2] The italics are mine.

It follows, from this independence in phylogenetic development of these secondarily formed ganglia, that we are not justified in taking any one of the ganglia of the higher Cephalopods and saying this is the "pedal" ganglion (implying in the term "pedal" accurate homology with the so-named ganglia of Gasteropoda)—*à fortiori*, in asserting here is an organ innervated by the pedal ganglion, therefore it is morphologically part of the foot. Yet it is precisely this latter line of argument which modern exponents of the "pedal" hypothesis use as their mainstay.

The central nervous system of Cephalopoda may be said, according to what we know of *Nautilus*, to consist primarily of—

(1) A supra-œsophageal mass, connected with
(2) An anterior sub-œsophageal, and
(3) A posterior sub-œsophageal mass.

To these is added *in the Dibranchiata* a separate nervous mass lying in front of (2)—the brachial ganglion; and it is this which innervates the arms.

To quote Pelseneer (Chall. Rept. p. 65):—

> "Regarding (1) there is no disagreement as to its nature, all recognizing in it the fused cerebral ganglia.
>
> (2) "Has been universally regarded as constituted by the pedal ganglia.
>
> (3) "Corresponds to the combined visceral ganglia of other Mollusca.
>
> "All observers are agreed as to the interpretation of the supra-œsophageal and the two posterior sub-œsophageal masses (*i. e.* (2) and (3)). The disagreement relates only to the brachial ganglia, which are regarded by one party as pedal and by the other as cerebral."

Pelseneer then goes on to combat the view that the brachial ganglion has been derived from the fusion of a downgrowth on each side from the cerebral ganglion.

While protesting, in passing, against the statement that the supra-œsophageal nerve-mass is formed of "the fused cerebral ganglia," when in reality it represents the primitive nerve-mass out of which "cerebral ganglia" have not yet become segregated, it is (2) the statements as to the "pedal" and brachial ganglia which concern most closely the point under discussion. The one fact of independence of evolution is enough to show that the so-called pedal ganglion of Cephalopods—*i. e.* the anterior sub-œsophageal nerve-mass of *Nautilus*, which in the higher Cephalopods has, in accordance with a very general law, become condensed into a definite ganglion, supplying the various organs originally in its neighbourhood—is not in the strict morphological sense the "pedal" ganglion at all. One may then accept with Pelseneer the development of the brachial ganglion by splitting off from this anterior sub-œsophageal nerve-mass, and yet be as completely without evidence as we were before that the structures supplied by it have anything whatever to do with the foot.

In brief it appears to me that:—the general relations of the parts point undoubtingly to the arms of Cephalopods being processes of the head-region—that all the special evidence brought forward to support the pedal view is either erroneous, of little weight, or is permeated with fallacy—and that it therefore behoves us in the meantime to unhesitatingly accept the first mentioned[1].

IX. *The Phylogenetic Relationships of the Cephalopoda.*

From its archaic character Nautilus might be expected to give valuable hints as to the phylogenetic relationships of the group to which it belongs. Upon the whole it appears to me that its structure affords strong evidence that the nearest living allies of the Cephalopoda are to be found in the Amphineura. And it is interesting to note that amongst these it is the Chitons in which the points of resemblance are most striking, as they are apparently the oldest and most primitive members of the group. The number of really important morphological features in which the Chitons resemble *Nautilus* is really remarkable, *e. g.*—

(1) Its bilateral symmetry.
(2) The general characters of its nervous system.
(3) Its possession of paired metamerically arranged ctenidia, of which in some species, believed to be phylogenetically younger, there is a tendency for those at the anterior end of the body to disappear—only those towards the posterior end persisting (*mero-branchiate* forms).

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[1] The forerunner of the hood-tentacle complex of *Nautilus* (and consequently of the arms of the Dibranchiata) we may probably see still persisting in the similarly innervated and highly sensitive mass which surrounds the mouth in *Chiton*.

(4) The traces of metamerism exhibited by the heart in some forms, there existing several pairs (four in *Chiton magnificus*) of auriculo-ventricular openings.
(5) General relations of cœlom, nephridia, &c.
(6) Eggs developed within follicles.

Fig. 6.

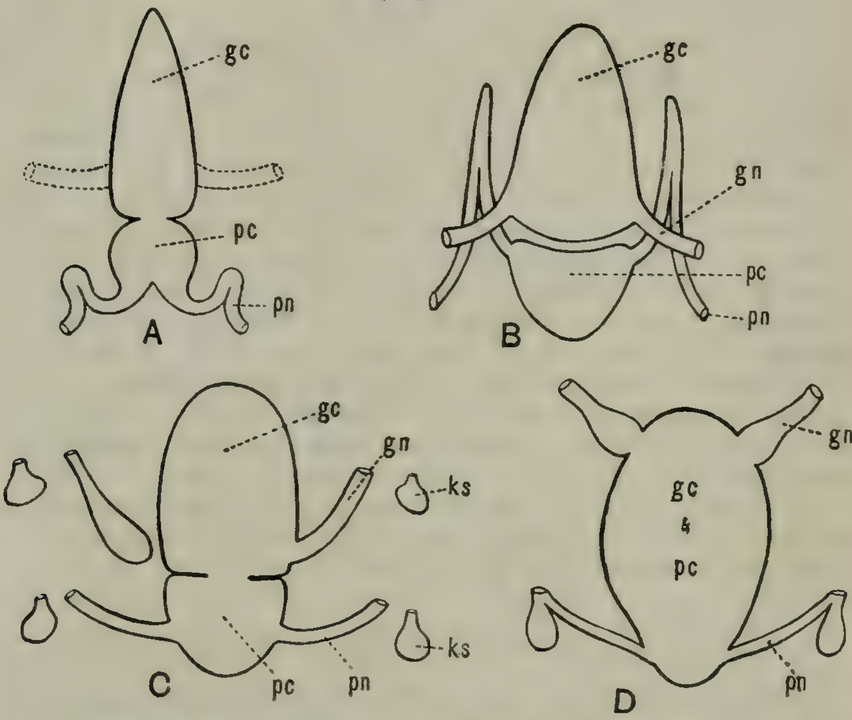

Diagram showing the relationships of the cœlom and nephridia in *Amphineura* and *Cephalopoda*.

A, *Chætoderma*; B, *Chiton*; C, *Nautilus*; D, *Sepia*.

gc, genital division of the cœlom; *pc*, pericardiac division of the cœlom; *gn*, nephridia of genital segment; *pn*, nephridia of pericardiac segment; *ks*, kidney-sacs in *Nautilus*; in *Sepia* the two posterior kidney-sacs are seen still in communication with the rest of the nephridia.

In regard to (5), fig. 6 indicates diagrammatically the relationships of the parts concerned. In the case of *Chiton* (B) two cœlomic chambers are shown, one lying in front of the other—the genital cœlom and the pericardium. The pericardium communicates with the exterior by a pair of functional nephridia; the genital cœlom by the pair of genital ducts which from their relations can hardly be otherwise than morphologically a pair of nephridia too. In *Chætoderma* (A), a less primitive animal, a less primitive arrangement has been developed: the genital division of the cœlom has developed a communication with the pericardium through which the genital products pass—and it has lost its original genital ducts.

Fig. C shows the condition in *Nautilus*, where again the same two cœlomic chambers are visible. Here also a communication has become formed between the two, but the two pairs of ducts to the exterior still persist—the anterior nephridium here still preserving its excretory portion—a more primitive condition than in *Chiton*, and probably to be correlated with the fact of its having become shut off from the main lumen of the duct. A few irregular apertures in the wall separating the two cœlomic chambers point towards the still later condition to be met with in *Sepia* (D), where the septum has disappeared—a faint rudiment remaining in the form of a transverse fold rising up from the floor of the common chamber[1].

X. *Summary of Conclusions.*

1. The perivisceral cavity in *Nautilus* is remarkable for the almost equal participation in its formation of both cœlom and hæmocœl.

2. The cœlom consists of two distinct chambers—genital and pericardial—separated by a perforated septum.

3. Each of these cœlomic chambers opens to the exterior by a pair of nephridia.

4. The genital ducts of the Cephalopoda represent portions of nephridia.

5. The ovary is remarkable for its extremely archaic character—an ovigerous region of the cœlomic epithelium, roofed in by a simple upgrowth of the cœlomic wall.

6. The ova arise from syncytial masses of protoplasm.

7. The testis is also archaic in character, and similar to the ovary in its main features. Its cavity, however, has become subdivided into numerous delicate tubes for the provision of increased area of the spermatogenic epithelium.

8. The penis is a paired structure, its left moiety, however, remaining rudimentary.

9. An elaborate buccal nervous system is present.

10. The "inner inferior lobe" is innervated not by a pair of distinct ganglia, but by a continuous nerve-cord.

11. Round the base of the postanal papilla is a curious system of skin-glands.

12. A prolongation backwards of the nerve-trunk which supplies the gills probably represents the postanal commissure of *Amphineura*.

13. A laminated organ lying below the mouth has a function in connection with copulation—the spermatophore of the male becoming attached to it.

14. The evidence as to the "pedal" nature of the Cephalopod arms appears to rest on insecure foundations, and it seems desirable

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[1] The view advocated by Grobben (Morph. Stud. p. 39) that the condition in *Sepia* is the more primitive, and that it represents a stage in the evolution of the condition met with in the other Mollusca, seems to me untenable.

to abandon it for the inherently much more probable view that these structures are processes of the head region.

15. *Nautilus* shows many strong resemblances to the Amphineura, and it is probably amongst these latter that we have to look for the nearest allies of the Cephalopoda.

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Fig. 1. Side view of an animal of *Nautilus pompilius*, extracted from the shell. The funnel has been opened out and the mantle-flap partly cut away so as to give a better view of the various parts.

h, hood ; *t*, tentacles ; *e*, eye ; *f*, funnel separated by a deep groove from the hood-tentacle mass ; *m*, cut edge of mantle-flap ; *g*, gill ; *s*, siphuncle.

Fig. 2. Longitudinal section through the animal of *Nautilus* very slightly to the right of the middle line.

b, buccal cavity ; *r*, radula ; *cg*, supra-œsophageal nerve-cord ; *pl.g.*, posterior sub-œsophageal nerve-cord ; *p.g.*, anterior ditto ; *f*, funnel with its valve ; *ph*, crop with at *giz.* its opening into the gizzard ; *int.*, intestine ; *an*, anus ; *k*, kidney-chamber with follicular appendages of advehent vein projecting into it ; *p.foll.*, pericardial gland-follicles projecting into pericardium ; *v.c.*, vena cava.

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The outer wall has been removed so as to show *a* and *b*—the right and left halves of the penis.

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Fig. 3. The same organ in its more usual (paired) form.

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The 'Proceedings' are issued in *four* parts, as follows:—

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II. „ „ „ March and April, on August 1st.
III. „ „ „ May and June, on October 1st.
IV. „ „ „ November and December, on April 1st.

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PROCEEDINGS

OF THE

GENERAL MEETINGS FOR SCIENTIFIC BUSINESS

OF THE

ZOOLOGICAL SOCIETY OF LONDON

FOR THE YEAR

1895.

PART IV.

CONTAINING PAPERS READ IN

NOVEMBER AND DECEMBER.

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November 19, 1895.

Sir W. H. Flower, K.C.B., LL.D., F.R.S., President, in the Chair.

The Secretary read the following reports on the additions made to the Society's Menagerie during the months of June, July, August, and September, 1895:—

The total number of registered additions to the Society's Menagerie during the month of June was 212, of which 32 were by birth, 61 by presentation, 20 by purchase, 3 by exchange, and 96 were received on deposit. The total number of departures during the same period, by death and removals, was 90.

The registered additions to the Society's Menagerie during the month of July were 132 in number. Of these, 58 were acquired by presentation, 3 by purchase, 19 by exchange, 28 by birth, and 24 were received on deposit. The total number of departures during the same period, by death and removals, was 94.

Among these, special attention may be called to the following:—

1. An Alexandra Parrakeet (*Polytelis alexandræ*), from the Interior of Australia, deposited July 11th, being the first specimen of this beautiful species brought to Europe alive.

2. An example of the very singular Frilled Lizard of Western Australia (*Chlamydosaurus kingi*), obtained in Roebuck Bay, Western Australia, and presented, July 22nd, by W. Saville Kent, Esq., F.Z.S. (see p. 712).

The registered additions to the Society's Menagerie during the month of August were 229. Of these, 54 were acquired by presentation, 17 by purchase, 21 by birth, 29 were received on deposit, and 108 by exchange. The total number of departures during the same period, by death and removals, was 101.

Amongst these special attention may be called to the following:—

1. A Basilisk Chameleon (*Chamæleon basiliscus*) from Egypt, presented by Mr. J. Buchanan, August 1st. Of this Chameleon, which occurs in Egypt, as well as the Common Chameleon (*Chamæleon vulgaris*), we have not previously received living specimens.

2. Two examples of the peculiar North African Rodent, the Gundi (*Ctenodactylus gundi*), purchased August 12th of Mr. Paul W. H. Spatz, by whom they were brought from Tunis.

3. A fine young specimen of the Martial Hawk-Eagle (*Spizaëtus bellicosus*), captured near Mount Kenia, in British East Africa, and presented to the Society by Dr. Kolb, through Capt. Sclater, R.E.

The only previously received example of this species was a specimen from Table Farm, Grahamstown, South Africa, presented by Mr. T. White on Oct. 24, 1892. This Hawk-Eagle seems widely distributed in Africa, and has been recorded from German East Africa by Dr. A. Reichenow (see his book 'Die Vögel Deutsch-Ost-Afrikas,' page 88: Berlin, 1894).

The registered additions to the Society's Menagerie during the month of September were 79. Of these, 35 were acquired by presentation, 6 by purchase, 27 were bred in the Gardens, and 11 were received on deposit. The total number of departures during the same period, by death and removals, was 109.

The Secretary read the following extract from a letter addressed to him by Mr. J. H. Gurney, F.Z.S., respecting the skin of a Kingfisher which he had exhibited at a meeting of the Society held on the 7th May, 1895:—

"I received not long ago two skins of the beautiful Beavan's Kingfisher, *Alcedo beavani*, Wald., from Mr. A. L. Butler, obtained by that gentleman at Lunugala, Ceylon, November 2nd, 1894, and April 12th, 1895, one of which was exhibited to the Society last May[1] under the impression that the species was new to the avifauna of Ceylon. Such, however, turns out not to be the case, for Mr. A. P. Green of Colombo has informed Mr. Butler that he met with this species at Dambool in 1892, and has since secured several examples of both sexes, and considers it to be a permanent resident in some parts of the island."

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[1] See P. Z. S. 1895, p. 339.

Mr. Sclater gave a short account of the principal animals he had noticed in the Jardin d'Acclimatation and Jardin des Plantes at Paris during a recent visit.

The Jardin d'Acclimatation contained a fine herd of *Cervus davidianus*, males, females, and young, six in all. The larger Antelopes represented there were the Sing-sing (*Cobus unctuosus*), of which there were a male, two females, and a young one; White-tailed Gnus (*Connochætes gnu*), also breeding; and Bubals (*Bubalis buselaphus*), of which a pair were accompanied by a young one, born 15th June, 1894; besides Elands, Beisas, and Leucoryxes. The single Giraffe was a fine large male, born in the Gardens 13 years ago. An old female African Elephant (22 years in the Gardens) was employed in carrying children, besides which there were several young Indian Elephants. There was a single Mountain Zebra (*Equus zebra*).

Specimens of the following birds were in the collection:—*Pteroglossus inscriptus*, *Rallus rytirhynchus*, *Bucorax abyssinicus*, *Trichoglossus ornatus*, *Tinamus tataupa*, and *Ortyx pectoralis*.

The colony of Penguins (*Spheniscus demersus*)[1] consisted of six or seven pairs, several of which were nesting.

In the Jardin des Plantes there was a male African Elephant, now about 16 years in the Garden, a female Hippopotamus, received as a present from Halim Pasha in 1875, a female *Equus zebra*, and a female *Cervus maral*, which had bred with a Red Deer. Among the Antelopes were several examples of the Bubal (*Bubalis buselaphus*) from Eastern Algeria, on the frontiers of Marocco, and a fine young male Kob (*Cobus kob*) from the Gambia, which was a rare species in captivity. The herd of Pleasant Antelopes (*Tragelaphus gratus*)—*cf.* P. Z. S. 1883, p. 34, pl. viii.—now consisted of two females and an adult and young male.

Mr. Sclater read the following extracts from a letter addressed to him by Mr. R. Crawshay, dated Deep Bay, Lake Nyasa, British Central Africa, April 25, 1895:—

"Shortly after writing to you in January last I made a journey into the Henga country, three days S.W. of this, and procured the specimen that I promised to get you of the Zebra of these parts.

"It is a male, very aged I should say, and a good specimen. I have preserved it as carefully as circumstances would permit in the rains, and in a wet country like Henga. It is complete—hide, leg-bones, hoof, and skull. It appears to me to be neither of the two Zebras, *Equus zebra* nor *E. burchelli*, but a combination of the two, most resembling the variety of Burchell's known as *E. chapmani*. In colour it does resemble *E. zebra*, the stripes are absolutely black and white throughout, except on the curly tuft of yellowish-brown hair at the back of the fetlock, the few brown markings dotted about the rest of the tail, the reddish-brown about the lower part of the face, the yellowish-white ring round the coronet reaching to the hoof. The legs are marked like those of *E. chapmani*, that is, they are striped almost, if not quite, down to the feet, though nearly black from the fetlock to the yellowish-white ring round the coronet. The Henga animal comes near Burchell's Zebra in height: in other respects I see no resemblance between the two, except, perhaps, in the beginning of the stripes on the back and flanks.

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[1] *Cf.* P. Z. S. 1891, p. 326.

"In my specimen some of the broader black stripes—notably the one down the centre of the belly—are divided into two by a thin white streak.

"The following are some measurements of the specimen taken immediately after death:—Height at withers $54\frac{1}{2}$ inches. Length over all, upper lip to end of tail (not tail-hairs) $108\frac{1}{4}$ inches; tail $15\frac{7}{8}$; tail-hairs $15\frac{3}{8}$.

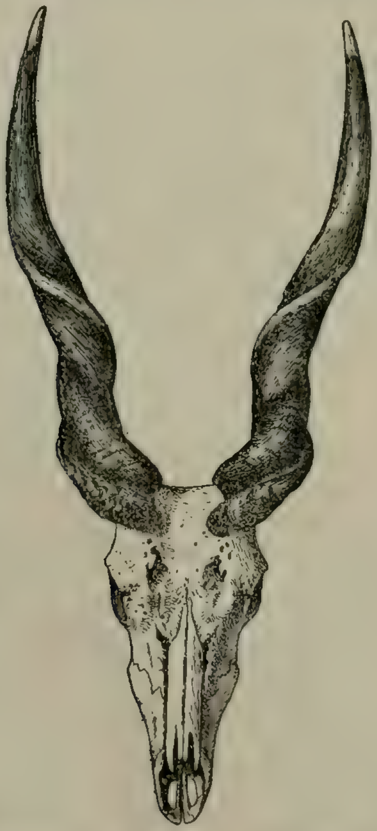
"I don't know that there is anything special to tell you about the Zebra of Henga as compared with other Zebras. Their habits are pretty much the same. They go about in troops of from four or five to eight or ten, more usually five, which are closely located to one another, but have each their own paths, feeding-grounds, and drinking-places. These troops generally amalgamate in the dry season, probably for protection against surprise by Lions. I remarked one troop in November, 1893, which I think could not have numbered less than 60 or 70, though this is nothing to what one has seen in the Mweru country, where they go on the Mofwi plains in troops of some 200 or so. Frequently the Zebras of Henga remain out in the sun on the plains all day long, not retiring into covert at all. They are then an intolerable nuisance to anyone in pursuit of other game—indeed, this may be said of them at all times. If once they notice you they draw in and mob you in their curiosity—only, however, when one takes no interest in them, for when they fancy they are the object of the intruder's attention no animals are more watchful and cunning in safe-guarding themselves. If only this curiosity were manifested in silence, it would not so much matter, but it vents itself in snorts and thundering stampedes, which puts every beast within ear-shot on the *qui vive*.

"Henga is a portion of the Loangwa Valley, about 3300 feet, on the mean, above sea-level. It is fairly healthy, and you can do your shooting and collecting there in comparative comfort, in a climate which is cool after the stifling heat of the Lake-shore and the land below the plateau. My Zebra was shot here on 31st January, 1895, close to Ngunga, a respectable stream flowing into the Loangwa from the hills bordering Nkamanga to the westward."

Mr. Sclater exhibited the skin in question, which he proposed to present in Mr. Crawshay's name to the British Museum, and remarked that he regretted that he could not agree with Mr. Crawshay's views as to the specimen being referable to a new species. Mr. Crawshay's skin corresponded nearly to the mounted specimen of *Equus burchelli* from Mashunaland (*Selous*) in the gallery of the British Museum. It was well known that this Zebra varied much in different localities. The original *Equus burchelli* of the Cape Colony (of which specimens were formerly living in the Society's Menagerie) was almost unspotted on the legs. As it occurs further north, however, this animal appeared to become more and more barred on the legs, until we arrived at the condition exhibited by the present specimen. There was also much variation in the body-markings in *E. burchelli*, as would be seen on inspection of the five examples of this Zebra living in the Society's Gardens.

Herr Matschie ("Die afrikanischen Wildpferde," Zool. Gart. xxxv. Hefte 2 & 3) had lately endeavoured to make 4 species out of these different climatic forms—*E. antiquorum*, *E. burchelli*, *E. chapmanni*, and *E. boëhmi*—but Mr. Sclater doubted whether they could be satisfactorily differentiated even as subspecies.

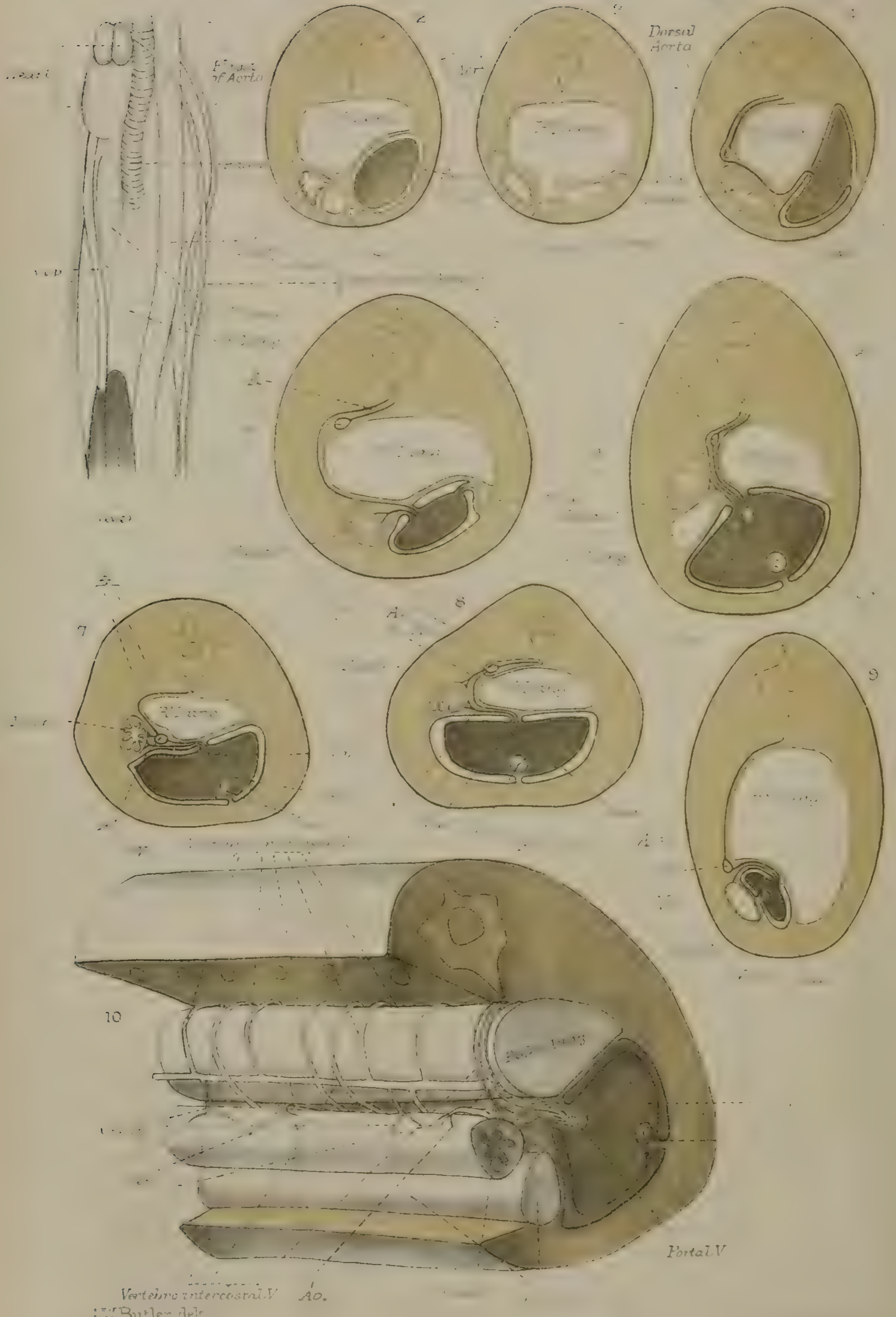
Mr. Sclater exhibited a remarkably fine pair of horns of a male Livingstone's Eland (*Oreas canna livingstonii*), which Mr. H. H. Johnston, C.B., F.Z.S., offered for the Society's acceptance. The animal had been shot by one of Mr. Johnston's hunters in 1893



Skull and horns of Livingstone's Eland, ♂.

BRITISH MUSEUM
NATURAL HISTORY

P.Z.S. 1895. Plate [illegible]



J.W. Butler del.
M.P. Parker lith.
West, Newman imp.

[illegible]

between Zomba and Lake Chilwa. The horns measured about 29½ inches in length, and were 16½ inches apart at their upper ends.

Col. L. H. Irby, F.Z.S., exhibited and made remarks on two specimens of the Greater Bullfinch (*Pyrrhula major*), killed on the coast of Yorkshire about 1st Nov., 1893.

Mr. W. T. Blanford, F.R.S., exhibited and made remarks on specimens of the Siberian Ibex (*Capra sibirica*) and the Ammon Sheep (*Ovis ammon*), shot by Major Cumberland in the Altai Mountains.

Mr. Swale Vincent, M.B. Lond., Demonstrator of Physiology and Histology, Mason's College, Birmingham, read a memoir entitled "Contributions to the Comparative Anatomy and Histology of the Suprarenal Capsules." This portion of the memoir dealt with the suprarenal bodies in Fishes and their relation to the so-called head-kidney.

This paper will be printed entire in the Society's 'Transactions.'

The following papers were read:—

1. On the Complete or Partial Suppression of the Right Lung in the *Amphisbænidæ* and of the Left Lung in Snakes and Snake-like Lizards and Amphibians. By Gerard W. Butler, B.A., F.Z.S.

[Received June 14, 1895.]

(Plate XL.)

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I. Introductory.

The absence of paired symmetry in the lungs of Snakes has been recognized from early times. Thus Aristotle [B.C. 384–322] describes Snakes (as known to him) as having but one lung[1]. We find this view repeated without qualification so late as 1805 in a work for which Cuvier is responsible[2].

It would seem that Nitzsch [1808] was the first to describe the rudiment of the second lung (which, be it noted, he rightly speaks of as the *left* lung) in the Common Snake (*Tropidonotus natrix*), and to suggest that this rudiment would probably be found in many other Snakes (**1**)[3].

Since 1808, thanks to such workers as Meckel, Cuvier, Duvernoy, Stannius, and Cope, our information on the subject has been largely augmented.

In a sense it may be said that, excluding details, there is little in this paper which has not been stated or hinted by some one previously. But it is equally true that there is little here which has not been as categorically denied by some one else of equal authority.

It has thus happened that an interesting generalization has so far been missed.

This is doubtless in part due to the fact that no one person has given special attention to the matter in all the groups of animals concerned, but in part also to error of interpretation, or error or looseness of description on the part of observers, and in part perhaps to want of caution on the part of compilers when summing up.

However this be, it seems well to have the facts placed clearly on record now.

When studying the pleuroperitoneal spaces and membranes of Lizards, Snakes, &c., in the years 1889–1892[4], I of course had to note the relations of the lungs, and I was much struck by the fact that whereas in the Amphisbænidæ it was always the right lung that was reduced or absent, in Snakes and in other Snake-like Lizards it was the left.

When I came to enquire what had previously been written on the subject, I found that there was no satisfactory summing up of the whole matter, and that so far as separate animals or groups of animals were concerned, while some previous statements harmonized with my observations, others of equal authority ran counter to them, while, thirdly, many writers did not commit themselves one way or the other. I have accordingly been over my old observations, and supplemented them by others, with the result of only confirming and widening the generalization at first arrived at, which is—[I of course speak only of the animals examined, see lists, § VI.]—that *the Amphisbænidæ stand alone*

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[1] Aristotle's 'History of Animals' (R. Creswell's translation in H. G. Bohn's "Classical Library"), Book ii. chap. ii. § 12, p. 44 (London, 1862).

[2] 'Leçons d'Anatomie comparée de Georges Cuvier, recueillies et publiées sous ses yeux par G. L. Duvernoy,' tom. iv. pp. 323 & 347 (Paris, 1805).

[3] See Bibliography at the end of this paper. Throughout the paper the large numbers in brackets inserted in the text refer to the corresponding work in the list at the end.

[4] Proc. Zool. Soc. 1889, pp. 452–474, and 1892, pp. 477–498.

among pulmonate vertebrates in having the right lung completely or partially suppressed.

The observations recorded in this paper are of course not exhaustive, but I think the types examined make up a good representative set; and though it is of course not safe from a knowledge of the anatomy of nine animals to prophesy as to that of a tenth though apparently nearly related, still I think the probability is that if we open a specimen of any species of Amphisbænid we shall find the left lung well developed and the right lung smaller, rudimentary, or absent, and that in any other animal, if one lung is markedly smaller, rudimentary, or absent, it will be the left lung.

In itself the suppression of one lung rather than the other does not perhaps appear to be a characteristic of great significance; and if, as has been stated, it were a fact that some Snakes had the right lung rudimentary and some the left, the case would be different. If, however, as my observations so far as they go indicate, the suppression of the right lung is really confined to one family of animals, which are peculiar and interesting in other ways, it is surely a point worth noting, both for its own sake and because it may probably be indicative of some less superficial peculiarity in the plan of organization of these animals.

I may perhaps be able to follow up the matter some other time when I more fully understand the significance of certain other peculiarities of these animals. The main object of the present paper is to state the facts observed.

If any exceptions to the generalization above stated should be discovered[1], I should be much interested to hear of them. Such exceptions, if they exist, would not improbably be suggestive in one way or another. Let no one, however, after reading this paper speak of a rudimentary left lung in an Amphisbænid or a rudimentary right lung in a Snake or any animal other than an Amphisbænid until he has first carefully re-examined his specimen in the light of what follows.

For permission to examine a number of species of which I do not myself possess specimens my best thanks are due to my former teacher Prof. G. B. Howes, and secondly to Mr. G. A. Boulenger, F.R.S. The latter has also very kindly named my specimens in accordance with his latest edition of the British Museum Catalogues of Snakes and Lizards.

II. A Review of previous Statements.

At the end of this paper will be found a list of the works which, so far as my knowledge goes, contain the most noteworthy contributions to the subject herein discussed. I will here briefly allude to these and to a few other references of lesser importance, partly to do justice to the authors named, and partly to show cause for the publication of this present paper.

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[1] For a discussion of the description and figure of the lungs of *Chirotes* by Cuvier and Flourens respectively, see below, pp. 694, 702.

I hope that anyone who has an opportunity of dissecting either *Chirotes* or any snake-like Lizards not mentioned in my lists will make an outline sketch of the heart, lungs, and liver, *in situ*, as seen from the ventral side, so as to show the relative size of the two lungs.

(i.) I have already referred to the work of Nitzsch [(1)]. His treatment of the matter is excellent, so far as it goes[1].

(ii.) J. F. Meckel [(2) p. 84], using of course an earlier system of classification in discussing the lungs of Snakes, noted correctly that in the Amphisbænidæ the rudimentary lung, if present, is on the right side, but he spoilt this observation by adding that this also was the case with all the "Colubers" he had examined[2]. He was again, however, right in saying that the smaller lung was on the left in all the Boas and *Tortrix scytale*, as well as in *Anguis fragilis.*

(iii.) In his later work [(3) pp. 259 & 260] he made another mistake in adding *Cæcilia*, as well as the Colubers, to the Amphisbænidæ as having the rudimentary lung on the right side. He was, however, right in placing *Platurus* and *Typhlops,* as well as the lizards *Ophisaurus*, *Pseudopus*, *Bipes*, and *Seps* with the Boas, *Tortrix*, and *Anguis* of his previous paper, as having the right lung the largest. As to *Chirotes*, which Amphisbænid, he avers, has the right lung much the largest, see below, pp. 702 & 703.

(iv.) The treatment of this subject in the second edition of Cuvier's 'Leçons d'Anatomie comparée' [(4)] shows in some respects a marked advance on the papers previously mentioned. Nevertheless, although we have details with regard to some animals given with greater accuracy and preciseness[1], and have in different places hints that Duvernoy had noticed that it was the rule for the left lung to be rudimentary in Snakes[2], much is from our present point of view left vague[3], and there seems to be at least one error[4], which is sufficient to prevent him arriving at a correct generalization.

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[1] Nitzsch, *l. c.* p. 13, after describing the lungs of Lizards, says that *Anguis fragilis* has the right lung rather longer than the left. He then describes the rudimentary left lung of *Tropidonotus* (*Coluber*) *natrix* :—

"In Colubro natrice autem sinistrum liberum, minimum, piso communi parum majorem, tamen cellulosum, dextrum contra maximum, longissimum . . . Quemadmodum vero in isto Colubro, ita in reliquis serpentibus, quibus auctores unum modo pulmonarem follem tribuunt, hoc organon comparatum [paired] esse autumaverim. Haud dubie sinister, quanquam minimus, vere adest. Non omnibus saltem serpentibus unum duntaxat pulmonem esse proposita exempla docent."

The expectation expressed in the last sentence but one is of course not fully borne out. There are a number of Snakes that have no trace of a second lung; but there are very many in which, as in *Tropidonotus natrix*, the left may be easily overlooked. I have thought it worth while to quote his words because he was apparently the first to describe this rudimentary left lung, because his description is so good, and because he at once grasped the fact that the rudimentary lung of such a Colubrine Snake is the left lung—a thing which has always seemed to me pretty obvious, but which has struck some other people differently.

[2] Meckel and Cope have used the terms "Colubern" and "Colubroidea" respectively [see (2) and (7)] in a wide sense almost co-extensive with the Linnean genus *Coluber*, so that under these headings come a large majority of known Snakes. This of course adds greatly to the importance of any general statement they make as to Colubers or Colubroidea. Further, if Meckel and Cope do not actually state that the rudimentary lung of these Snakes corresponds to the right lung of other animals, their writings tend to spread this view when, without further comment, they say that this rudimentary lung is "on the right side," or, as Cope, figure it as "right lung."

(v.) Stannius [(5)] errs in saying that the Amphisbænidæ agree with a number of other Snake-like Lizards which he mentions in having the left lung reduced [*l. c.* p. 206 and note]. As to Snakes, he mentions a number of kinds, and states whether they have more than one lung, but he does not say whether it is the right or left lung that is reduced.

(vi.) Milne-Edwards [(6)] gives a *résumé* with references to the literature of the subject. While, however (*l. c.* p. 308, note), he says that it is the left lung which is the smaller in Pythons, Boas, and Slowworm, and that it is the right which is rudimentary in Amphisbænidæ, at the top of the next page he says (speaking of Snakes) "l'atrophie du poumon porte tantôt à droite, tantôt à gauche."

(vii.) The recognized text-books and encyclopædic sources of information of still more recent date, so far as I have seen, either hardly touch upon the subject, or else do not convey a definite and correct impression of the whole matter[1].

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[1] Thus, on p. 37, Duvernoy rightly states that in Cæcilians the left lung (not the right, as Meckel had stated) is rudimentary, and on p. 38 gives exact measurements of the two lungs in different species of these Amphibians. On p. 32 he rightly repeats that the left lung of *Anguis fragilis* is the smaller.

[2] Thus, *l. c.* p. 33, after describing the lungs of *Eryx turcicus* [this should be a synonym of *Eryx jaculus*, L.], he adds, "Nous verrons dans les détails de la structure de ces deux sacs que le gauche répond au poumon rudimentaire des autres Ophidiens."

Again, on the same page, he describes the left lung as rudimentary in "l'Hétérodon tacheté" [*Heterodon platyrhinus*, Latr.], and, as will be noted below, p. 701, this is a Snake in whose case, if in any, it would be most natural to fall into the error of describing the rudimentary lung as the right.

Again on p. 36. After stating that there is no trace of a "second" lung in certain species of *Vipera* and other Snakes, he adds, "Mais il y a un rudiment du poumon gauche dans *l'Acanthophis tortor* . . ."—a passage which makes one think that though in various places he used the vague expression "deuxième poumon," he meant "poumon gauche."

[3] Thus on p. 32 we are told which lung is the smaller in *Pseudopus pallasii* [*Ophisaurus apus*, Pall.], *Ophisaurus ventralis*, and the Amphisbænidæ. In this 1840 edition of the 'Leçons,' as in the 1829 edition of the 'Règne Animal,' these snake-like forms are classed with the Snakes, and if, in accordance with the preceding note, we credit Duvernoy with recognizing that it is the left lung which is reduced or absent in Snakes, we must on the other hand note that he fails to remark that the Amphisbænidæ differ from Snakes and other snake-like forms in having the right, and not the left, lung reduced or rudimentary.

[4] On p. 28 we are told that "*Bipes lineatus*" has "le poumon droit moitié plus court que le gauche." Comparing this note with the corresponding passage of the 'Règne Animal' of 1829 (from which Duvernoy, in a note on p. 37, explains that he is quoting certain other statements), I gather (see 'Règne Animal,' 1829, tom. ii. p. 65) that he refers to *Scelotes bipes*, L. [Brit. Mus. Cat. Lizards, vol. iii. p. 414]; and if so he is mistaken, for this Lizard is no exception to the general rule, but has the right lung longer than the left.

I do not censure Duvernoy for making the not uncommon error of confusing right and left. But this error, to my mind, discounts the adjoining statement about the lungs of *Chirotes*, as to which see below, pp. 702 & 703.

(viii.) Lastly Cope [1894 (7) & (8)] has recently published two papers which touch on this subject. These are storehouses of facts, and except with reference to his treatment of this one point, so far as I have been over the same ground, I have very little to do beyond endorsing his statements. But just because his name carries such weight, his treatment of this point is one of the strongest justifications of the publication of this paper. It will, however, be best to defer further reference to these papers, and especially the accompanying figures, to the next section, where I justify the contrary view of the matter.

III. On the Complete or Partial Suppression of the Left Lung in Snakes.

(a) *On a means of distinguishing the Right Lung from the Left in Snakes.*

In deciding as to the homology of the lungs of Snakes, in which animals in most cases one is quite rudimentary if not absent altogether, Embryology is of course our surest and best guide when we are able to resort to it. Thus I have serial sections of a number of stages of *Tripodonotus natrix* which show the early development of the lungs from the first commencement of the shutting off (Lamprey fashion) from behind forwards of the œsophagus from the anlage of the lungs and from the trachea to a time when the lungs have attained a fair size. These show us that it is the left lung, and not the right, which is from the first smaller than the other, and which as the snake grows remains quite rudimentary. I have also early stages of *Zamenis gemonensis* which show in like manner that the functional lung of this second Colubrine also is the right lung.

As to those Snakes which in the adult show no trace of a second lung, the embryological evidence, judging by the forms I have been able to study, is not so clear, because I have found no trace of more than one lung from the first. Thus in *Vipera aspis* and *Typhlops lumbricalis* I have stages which show the lung from an early stage inclining to the right side, after the manner of the right lung in the corresponding stages of such a form as *Tropidonotus natrix*, but there is no trace of a left lung.

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[1] As examples of this later class, and in further justification of this paper, not in any spirit of ungrateful criticism, I may refer to the fullest accounts of the subject that I have come across in the works of this type most familiar to English students.

a. Wiedersheim ['Lehrbuch der vergleichenden Anatomie der Wirbelthiere,' 2nd ed. p. 650, Jena, 1886] speaks of "die Lungen der Ophidier, wovon sich haüfig, ganz wie bei Gymnophionen und Amphisbænen, nur die eine, und zwar die rechte entwickelt, während die linke entweder ganz schwindet, oder doch meist nur sehr rudimentär erscheint."

The words, taken by themselves, do not necessarily mean that in the Amphisbænians it is the right lung that is well developed, but I think they naturally tend to produce that impression, especially in the mind of the reader who is sufficiently interested in the matter to look up the figures of *Siphonops* (*l. c.* fig. 454, p. 585) and *Amphisbæna* (*l. c.* fig. 459, p. 589), for the lung of the latter is there drawn to the right of the trachea and otherwise in the position of a right lung.

b. Hoffmann, in Bronn's 'Klassen und Ordnungen des Thierreichs,' Bd. vi. Abth. iii. p. 1594 [in a part dated 1886], is responsible for almost precisely the same words as those used by Wiedersheim.

In the case of many morphological questions, it is considered sufficient to study the development of a single typical species. But in the present case this is not so; for my gainsayers represent that in some Snakes one lung is developed, and in some the other. Now embryological evidence is of course the most convincing, but it is manifestly hopeless to think of studying the development of the lungs of every species of Snake, and, in the absence of embryological evidence, that of comparative anatomy is quite cogent enough I think for our present purpose. I therefore propose to show how we may easily tell the right lung from the left in any grown Snake by the light of comparative anatomy.

In most pulmonate vertebrates there can of course be no doubt as to which is the right and which the left lung, for the two lungs hang in separate lateral portions of the body-cavity, separated from each other by one or, more usually, by two membranous septa. There can be no question about the matter in the case of Amphisbænians and other Lizards, and any discordant statements about the lungs of these animals must be simply the result of a mistake, whether on the part of the observer, the compiler, or the printer.

With Snakes, however, it is otherwise. In Snakes as we know[1] the body-cavity is in its anterior region obliterated except for the pericardium and the two sacs which encase the right and left halves of the liver; and moreover the viscera show a displacement of a more or less rotatory character. It thus happens that though, in the great majority of cases, the rudimentary lung, if present, will be found just where, after seeing the rudimentary lungs of snake-like lizards and of Gymnophiona, and also on embryological grounds, we should expect to find the rudiment of the left lung of a Snake—[viz. on the left posterior border of the heart]—still there are a few species, e. g. *Heterodon platyrhinus* [see (7) pl. xv. or (8) pl. xxviii., and figs. 1–4 of this paper], in which first appearances are somewhat deceptive, so far as the rudimentary lung is concerned. In like manner, though the larger, more dorsally situated lung which Cope speaks of as the "left lung" has in most cases, to myself personally, appeared pretty clearly to be the right lung, still in many cases the position of this lung is so far median, or partly inclining to the right and partly to the left side of the animal, that an observer whose studies had not led him to investigate closely the relations of the organs in these animals might be in doubt. Yet once looked at the right way, the lungs of Snakes present hardly more difficulty than the lungs of Lizards and Amphibians.

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[1] *Cf.* Proc. Zool. Soc. 1892, pp. 477–498.

As remarked above, and as is well known, the lungs of vertebrates are separated by one or more longitudinal septa. One of these contains the alimentary canal and is the median septum, marking the median plane of the body. This is composed of the dorsal ligament of the alimentary canal, the gastrohepatic and hepato-œsophageal membrane, and the ventral, or so-called "suspensory," ligament of the liver. The other membrane is that one which is so conspicuous in tailed Amphibians and most Lizards, passing from the dorsal surface of the right liver-lobe to the dorsal body-wall. This membrane which, with its fellow on the left side [which, however, except in Amphisbænidæ remains almost or quite rudimentary, owing apparently to the mechanical obstacle to its development offered by the laterally displaced stomach], can be traced either in the adults or the embryos of other pulmonate vertebrates, has under one name or another received much attention from those who in the last seven years have written on the membranes and septa of the vertebrate body-cavity[1]. We may, following Hochstetter, call it the "Hohlvenengekröse" (postcaval ligament), to express the idea that its hinder portion serves as a bridge for the posthepatic portion of the postcaval vein; or we may call it the "right pulmohepatic ligament," to express the idea that it, like its fellow of the other side when present, arises in the embryo [I speak of Amniota,—*Lacerta* and *Gallus*] in connection with the development of the lung and serves to attach it to the liver; or we may call it simply the right dorsal ligament of the liver. As a matter of fact this membrane, with the exception of its posterior portion, does not occur in Snakes as a membrane distinct from the median or gastrohepatic, for the body-cavity does not extend between the right lung and the œsophagus and stomach as in Amphibia and most Lizards. It is, however, well seen in many snake-like Lizards.

I have referred to these membranous septa because, as is so often the case with such membranes, they are the carriers of certain definite blood-vessels, which are to serve us as landmarks. The morphological position of these blood-vessels in relation to the various organs, and particularly to the lungs, we first of all fix by the fact of their running in these membranes, whose relations are so well known and clear in Lizards, and we then can use these same blood-vessels as landmarks in Snakes, where the membranous septa would otherwise be hardly traceable.

Fortunately for our purpose, in Snakes, as in some elongated snake-like Lizards and Amphibians, the blood-vessels referred to tend to occur as series of simple vessels instead of as a lesser number of larger branched vessels, and running as they do in a dorso-ventral direction they, so to speak, constitute a double or treble palisade between the two lungs [or to the left or right of the one lung which may be present].

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[1] F. Hochstetter, "Ueber das Gekröse der hinteren Hohlvene," Anat. Anz. Bd. iii. pp. 965–974 (1888).

Ravn, Archiv für Anat. u. Phys., Anat. Abth. 1889, pp. 123–154 & 412.

G. W. Butler, Proc. Zool. Soc. 1889, pp. 452–474.

H. Klaatsch, "Zur Morphologie der Mesenterialbildungen am Darmkanal der Wirbelthiere. Theil I. Amphibien u. Reptilien," Morph. Jahrb. 1892, pp. 385–450.

Thus, *firstly*, the aorta gives off dorsalwards a whole series of vertebro-intercostal arteries to the vertebral column and adjoining body-wall, and ventralwards arteries to the œsophagus and stomach, while from these a series of veins passes to the portal system of the liver. With the exception of a few Amphisbænidæ, in which all or part of the last-mentioned veins run in the right dorsal hepatic ligament [1], all the above-mentioned blood-vessels run in the median septum; and it will be seen that they form a well-marked palisade of vessels across the space between the mid-dorsal line of the liver and the vertebral column.

Secondly, starting from the aorta, we have arteries passing direct to the liver.

Thirdly, in a number of elongated snake-like Lizards [as was, I believe, first described for Lizards by Hochstetter [2] in *Anguis* and *Pseudopus* (*Ophisaurus*)] we find that the main part of the vertebro-intercostal blood of the hepatic region of the trunk is returned by a series of veins that run from the dorsal body-wall to the liver *via* its right dorsal ligament [3].

Now we find all of these above-mentioned series of blood-vessels fully developed in Snakes throughout the entire liver-region, as was admirably described by Schlemm [4] as early as 1826; and they show us that the larger, or only functional, lung of Snakes is the right lung.

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[1] *E. g.* in *Amphisbæna* and *Lepidosternon* most or all of the veins from the œsophagus and anterior part of stomach run in the right ligament, which of course in these cases joins the alimentary canal. In *Blanus cinereus* part of the veins run in the right and part in the median ligament; while in the "Emphyodont" *Pachycalamus* and *Trogonophis* the veins run, as is, so far as I am aware, the rule for all other vertebrates, in the median membrane.

[2] F. Hochstetter, "Beiträge zur Entwicklungsgeschichte des Venensystems der Amnioten. II. Reptilien," Morph. Jahrb. Bd. xix. Heft 3, pp. 428–501, pls. xv.–xvii., Dec. 1892.

[3] I find these veins running in the right dorsal ligament of the liver in *Scelotes*, *Lygosoma*, *Lialis*, and various *Amphisbænidæ*, e. g. *Amphisbæna*, *Lepidosternon*, *Pachycalamus*, and they doubtless occur in the other snake-like Lizards examined. There may be as many as five, as in *Amphisbæna*, and perhaps more, spaced throughout the whole length of the liver.

A well-marked series of corresponding vessels is seen in *Amphiuma* and also in *Ichthyophis*, though in the last case they do not spring so directly from the vertebral column, but arise, as Hochstetter says has been described by Semon, from the unpaired vein between the mesonephric excretory organs which comes to take the place of the posterior cardinals of that region.

[4] Fried. Schlemm, "Anatomische Beschreibung des Blutgefässystems der Schlangen," Zeitschrift für Physiologie (Ed. G. R. & L. Ch. Treviranus), Bd. ii. pp. 101–124, pl. vii. (Darmstadt, 1826). See especially pp. 115, 121 & 122. On p. 121 he notices the series of vertebro-intercostal veins flowing into the portal vein in the liver, which were so commonly omitted in the descriptions published between 1826 and Hochstetter's paper of 1892, while curiously the comparatively insignificant, but, if I may so say, orthodox, vein that brings back blood from the first few postcardiac segments was always duly noticed.

When, as is commonly the case, the various longitudinally disposed viscera (the alimentary canal, liver, lung, and the longitudinal vascular trunks) between which they run are displaced from the positions they occupy in other animals, the course of these vessels is correspondingly circuitous. In fact, as the figures [Pl. XL. figs. 2–9], show, in passing from the vertebral column to the mid-dorsal line of the liver, they frequently have to describe a semicircle to pass round the mesial or left side of the larger right lung, which commonly encroaches considerably on the left half of the body.

Without very careful dissection the student may not in every uninjected spirit-specimen that comes into his hands find all the blood-vessels above referred to. I have not done so myself. In some cases I have found them all; in others now some series of vessels, now others; but in all the Snakes in my list I have obtained sufficient evidence from the blood-vessels to make it clear that the larger or only lung is the homologue of the right lung of other vertebrates.

(b) *Some Remarks on Prof. Cope's Papers on the Lungs of Snakes.*

Having thus presented what I believe to be without any shadow of doubt the correct view of the matter, and pointed out a simple means by which anyone may test the truth for himself, I think all that remains for me to do further is to explain away the apparently conflicting evidence of the figures in Prof. Cope's papers above mentioned [(7) and (8)]. I say the conflicting evidence of his figures, because in more than one place [(7) pp. 218 and 219, and (8) pp. 836 and 838] Prof. Cope expresses himself so as to suggest that he did not wish to commit himself to a use of the terms "right" and "left" in a morphological sense, but that he rather wished to designate those lungs which [in his opinion] are situated more to the right or left side of the animal. But when in his figures he labels the lungs R.L. and L.L. respectively, and in his explanation of the plates states that these letters stand for right lung and left lung, I think that the reader does carry away the impression that by these he means the lungs which are the homologues of the right and left lungs of other animals; and this impression will be deepened by certain passages in the papers [*e.g.* (7) p. 223 and (8) p. 838].

Now if we except *Typhlops* [(7) pl. xi.], which is one of the very few Snakes in which Cope will allow the "left" lung to be absent or smaller than the "right," we find that Cope in all his plates calls the best developed lung the "Left" lung and the smaller or rudimentary one the "Right"; and thus his figures are, as they stand, decidedly misleading.

While saying this I would, however, cordially acknowledge that the figures appear to have been carefully and truthfully drawn from the dissections, and such being the case, a comparatively brief cross examination of the figures brings out the truth.

Those who have carefully dissected this part of Snakes, and doubtless Prof. Cope himself among the first, will admit that the animals represented in (7) pls. xii., xiii., xiv., xv., and xvi., must have been prepared for sketching by cutting through the membranous tissue that connects the alimentary canal with the mid-dorsal line of the liver (and carries veins from the alimentary canal to the liver), and also the membranous tissue which passes to the right of the alimentary canal and attaches the liver to the dorsal body-wall and bears other blood-vessels to the liver; and will see that after cutting of these dorsal attachments of the liver that organ has either been merely pushed aside, as in pls. xiii. and xiv., or on the other hand has been turned over bodily through some 180 degrees, as in pls. xii., xv., and xvi. In either case the position of the lung with regard to the liver is not the natural one, and the impression is conveyed that the lung lies more to the left of the median plane than it really does.

That the membranes have been cut through, and the liver displaced as described, will, as remarked, be granted by those who have carefully studied this region of the snake's body, because of the unnatural position of the liver; but the displacement with inversion through some 180°, in the case of the snakes figured on plates xv. and xvi., will be recognized by all who remember that in Snakes, as in other animals, the postcaval vein enters the right half of the liver and not the left. The figures, in fact, are drawn in all good faith and tell their tale truthfully when carefully questioned, but the lettering and their appearance on the face of them are misleading.

The most striking figure is that of *Charina bottæ* [*l. c.* plate xii.] [one of the more normal two-lunged forms], where, after cutting through the dorsal attachments of the liver, the lungs and liver have evidently been turned over together in one piece to the right, so that the lungs lie ventral to the liver, with the larger right lung on the left and described as the left, and the smaller left lung on the right and described as the right.

We may now turn to consider the case of *Heterodon platyrhinus* [the curious forward diverticulum of whose chief lung has long been known[1]]. Cope figures this snake in both of his papers (7) pl. xv. and (8) pl. xxviii., and on account of its special interest in another respect I figure part of it here also [Pl. XL. fig. 1].

In this snake the position of the rudimentary lung with regard to the other, which is just as represented in Cope's figure, is at first view very deceptive.

It will be seen that the smaller rudimentary lung lies ventral to the other and to the right of the trachea. Not only, however, does the position of the larger lung with regard to the other organs, and notably to the blood-vessels above mentioned, prove that larger lung to be the right lung, but sections [see figs. 2–4], showing as they do a corresponding rotatory displacement of the organs (œsophagus, and aortic roots, &c.), explain the deceptive position of the rudimentary left lung.

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[1] See Duvernoy, 'Leçons d'Anat. comp. de G. Cuvier,' 2nd ed. tom. vii. p. 138 (1840).

Only one or two Snakes among those which I have examined are so deceptive as *Heterodon platyrhinus*, in the matter of the situation of the rudimentary lung, and none more so; and thus, having explained this case, I need not, I think, discuss any others, since all those that have come under my notice can be explained in the same way.

I give, however, a few other figures [figs. 5–9] of sections through different Snakes to show the kind of displacement of the viscera one finds, and to show how what is morphologically the median plane is indicated by the blood-vessels.

On referring to the figures we note that the characteristic displacements are—(1) of the right lung from the right side into a dorsal position underlying the vertebral column and extending more or less into the left half of the body, and, corresponding to this, displacements (2) of the œsophagus along the left side ventralwards, (3) of the aorta to the left side, and (4) of the liver towards the right side.

IV. ON THE COMPLETE OR PARTIAL SUPPRESSION OF THE RIGHT LUNG IN AMPHISBÆNIDÆ.

A reference to the list on p. 706 (which includes species of all the genera of *Amphisbænidæ* in the British Museum Catalogue, with the exception of the rare forms *Chirotes*, *Rhineura*, and *Agamedon*) shows that with the exception of *Trogonophis wiegmanni*, and to a lesser extent of *Pachycalamus brevis*, the right lung is rudimentary or absent altogether in all the Amphisbænidæ examined, while in these two it is distinctly smaller than the left. So far, then, as my observations go, this would seem to be a characteristic peculiarity of the Amphisbænidæ.

As to *Chirotes*[1] two writers[2] have made themselves responsible for the statement that the right lung is much larger than the left; while a third[3] has given a figure of the lungs apart from the other organs, in which the larger lung is called the right. This evidence would at first sight seem to settle the matter, and of course it is quite possible that the published view is correct. As *Chirotes* differs markedly from the other Amphisbænidæ in its possession of fore limbs, why, it may be said, should it not differ in respect of its lungs? Nevertheless, if, as seems indicated by its outward appearance, and as appears to be agreed by those who have studied its anatomy, *Chirotes* is an Amphisbænid, there is a certain presumption in favour of our finding the left lung the larger, so that I should like to know that the statements to the contrary were based on an inspection of the lungs *in situ* before considering the point decided[1].

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[1] For a preliminary notice of a division of these animals into three genera, see Cope, "On the Genera and Species of Euchirotidæ," American Naturalist, May 1894, pp. 436–7 (figures in text).

[2] Meckel (3) p. 260; and Duvernoy (4) p. 28.

[3] P. Flourens, 'Mém. d'Anat. et de Phys. comp.—1. Études sur les lois de la symétrie dans le Règne Animal et sur la théorie du dédoublement organique,' Paris, 1884, pl. i. fig. 4.

V. ON THE SMALLER SIZE OF THE LEFT LUNG IN (1) CERTAIN SNAKE-LIKE LIZARDS AND AMPHIBIANS AND (2) CERTAIN MAMMALS.

Having noticed that the Amphisbænidæ differed from Snakes in having their right lung, and not their left, reduced or absent, I was led to examine various other snake-like Lizards and Amphibians to see whether they in this respect agreed with the Amphisbænidæ or with the Snakes. A reference to the list given (p. 706) shows that I find that in all the lizards examined if one lung is smaller it is the left, and the same is true of the Gymnophiona examined, which is in accord with Wiedersheim's account based on more extensive acquaintance with this group.

Lastly, in many (according to some authorities in most[2]) mammals the right lung is larger than the left, sometimes considerably larger[3].

With the exception of Snakes, certain snake-like Lizards, Gymnophiona, and some mammals, all vertebrates, I believe, have both lungs well developed and either equal or differing but slightly in size; and the Amphisbænidæ appear to be the only animals in which the right lung is rudimentary.

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[1] Specimens of *Chirotes* being scarce, our knowledge of the soft anatomy is probably derived chiefly from specimens which have been sacrificed to make skeletons, such organs as the lungs being put up separately in spirit. Of course descriptions based on such preparations would be unreliable as evidence on the point in question. Flourens's figure is ostensibly drawn from such a preparation; while that Meckel (and apparently Duvernoy also in one instance) has made incorrect statements as to the right and left lungs of other animals I have shown above (p. 694, and note 4 on p. 695).

There is, it seems, no dissected specimen of *Chirotes* in London. I have tried by writing to what seemed a likely quarter to ascertain whether there exists in Paris any preparation showing the visceral anatomy of *Chirotes*, but so far without success. It is to be hoped that anyone who is able to dissect this rare form will sketch the organs *in situ*.

[2] Thus G. L. Duvernoy, 'Leçons d'Anatomie comparée de Georges Cuvier,' 2nd ed. tom. vii. pp. 20, 24, 25 (Paris, 1840).

H. Milne-Edwards, 'Leçons sur la Physiologie et l'Anatomie comparée de l'Homme et des Animaux,' tom. ii. p. 334 (Paris, 1857).

[3] Thus the preparations exhibited at the Royal College of Surgeons show the right lung markedly the larger in *Talpa europæa*, *Mus decumanus*, *Notoryctes typhlops*, *Hyrax capensis*, *Synetheres* (*Cercolabes*) *mexicanus*, and less markedly so in various other mammals.

VI. LIST OF SPECIES OF SNAKES AND SNAKE-LIKE ANIMALS EXAMINED.[1]

	1 Number of specimens examined.	2 Larger Lung.	3 Length of the Smaller Lung, that of the larger being taken as unity.[3]	
OPHIDIA.[2]				
Fam. I. TYPHLOPIDÆ.				
Typhlops lumbricalis, *L.*	2 & Em.	R.	——	
„ sp.	1	R.	——	
„ sp.	1	R.	——	
Fam. II. GLAUCONIDÆ.				
Glauconia albifrons, *Wagl.*	1	R.	——	*
Fam. III. BOIDÆ.				
Subfam. 1. *Pythoninæ.*				
Python molurus, *L.*, ♂	1	R.	·71.	*
„ „ ♀	1	R.	·57.	
„ reticulatus, *Schn.*	1	R.	·50.	
Subfam. 2. *Boinæ.*				
Boa constrictor, *L.*	2	R.	·50, & 58.	*
Enygrus carinatus, *Schn.*, ♀	1	R.	·75.	
„ „ (young)	4	R.	·60.	
Epicrates cenchris, *L.*	1	R.	·62.	
Eryx johnii, *Russ.*	1	R.	·57.	*
„ jaculus, *L.*	1	R.	·40.	*
Fam. IV. XENOPELTIDÆ.				
Xenopeltis unicolor, *Reinw.*	1	R.	·45.	*
Fam. V. ILYSIIDÆ.				
Ilysia scytale, *L.*	1	R.	sm. rud.	
Cylindrophis rufus, *Laur.*	2	R.	rud.	
Fam. VI. UROPELTIDÆ.				
Rhinophis blythii, *Kel.*	1	R.	rud.	

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[1] The names in the following lists represent the species so described in the latest edition of the British Museum Catalogues of Snakes and Lizards, the specimens having been kindly identified for me by Mr. G. A. Boulenger himself. Thus a reference to those Catalogues will tell the reader what animal is meant, if he is in doubt. In some cases, however, I have added, in brackets, commonly used synonyms.

[2] I only give the Snakes which I have myself examined. Some of these have been previously examined for the lungs by Prof. Cope (these I have marked *), and a number of other species will be found in his paper (7).

[3] In these elongated forms, with rare exceptions, such as *Pygopus*, the other dimensions of the lungs vary roughly in proportion to the length.

In these lists "rud." signifies that the smaller lung is so small, not more than $\frac{1}{10}$ the length of the larger, and usually much less, that it can be of no appreciable use.

Sm. rud. (small rudiment) signifies that extra care will be needed to find the rudiment, as by cutting open the trachea as advised by Cope, (7) p. 224, so as to find its internal orifice.

A line thus —— signifies that I have not found a rudiment.

Fam. VII. COLUBRIDÆ.				
Series A. AGLYPHA.				
Subfam. 1. *Acrochordinæ.*				
Chersydrus granulatus, *Schn.*	1	R.	———	*
Subfam. 2. *Colubrinæ.*				
Tropidonotus natrix, *L.*	14 & Em.	R.	sm. rud.	
Zamenis gemonensis, *Laur.*	4 & Em.	R.	smallest trace.	
Coluber (Elaphis) quatuorlineatus, *Lacép.*	2 & Em.	R.	sm. rud.	
„ (Compsosoma) melanurus, *Schleg.*	1	R.	rud.	
„ (Pituophis) catenifer, *Blainv.*	1	R.	———	
„ longissimus, *Laur.*	3	R.	sm. rud.	
Ablabophis rufulus, *Licht.*	1	R.	———	
Lycophidium capense, *Smith*	1	R.	———	
Dendrophis pictus, *Boie*	4	R.	sm. rud.	*
Lystrophis (Heterodon) d'orbignii, *D. & B.*	2	R.	———	*
Heterodon platyrhinus, *Latr.*	1	R.	rud.	*
Coronella (Ophibolus) getula, *L.*	2	R.	———	*
Petalognathus (Leptognathus) nebulatus, *L.*	1	R.	sm. rud.	*
Liophis pœcilogyrus, *Wied*	4	R.	sm. rud.	
Oligodon sublineatus, *D. & B.*	1	R.	rud.	
Aspidura trachyprocta, *Cope*	2	R.	rud.	
Subfam. 3. *Rachiodontinæ.*				
Dasypeltis scabra, *L.*	1	R.	sm. rud.	
Series B. OPISTHOGLYPHA.				
Subfam. 4. *Dipsadinæ.*				
Dipsas ceylonensis, *Gthr.*	2	R.	sm. rud.	
Cœlopeltis lacertina, *Wagl.*	1	R.	———	
Dryophis prasinus, *Boie*	1	R.	———	
Leptodeira rufescens, *Gm.*	2	R.	sm. rud.	
Psammophis crucifer, *Daud.*	1	R.	———	
Philodryas olfersii, *Licht.*	1	R.	sm. rud.	*
Subfam. 5. *Homalopsinæ.*				
Homalopsis buccata, *L.*	1	R.	———	
Fordonia leucobalia, *Schleg.*	1	R.	sm. rud.	
Subfam. 6. *Scytalinæ.*				
Oxyrhopus tergeminus, *D. & B.*	1	R.	sm. rud.	
Series C. PROTEROGLYPHA.				
Subfam. 7. *Elapinæ.*				
Elaps fulvius, *L.*	1	R.	———	*
„ hygeia, *L.*	3	R.	rud.	
Bungarus semifasciatus, *Kuhl*	1	R.	rud.	*
Subfam. 8. *Hydrophinæ.*				
Hydrophis fasciatus, *Schn.*	1	R.	———	
Hydrus (Pelamis) platurus, *L.*	1	R.	———	
Platurus laticaudatus, *L.*	1	R.	———	*
Fam. VIII. AMBLYCEPHALIDÆ.				
Amblycephalus boa, *Boie*	1	R.	rud.	
Fam. IX. VIPERIDÆ.				
Subfam. 1. *Viperinæ.*				
Vipera berus, *L.*	3	R.	———	
„ aspis, *L.*	2 & Em.	R.	———	
„ arietans, *Merr.*	1	R.	———	
„ nasicornis, *Shaw*	1	R.	———	
Cerastes cornutus, *Forsk.*	1	R.	sm. rud.	
Subfam. 2. *Crotalinæ.*				
Crotalus durissus, *L.*	1	R.	———	
„ horridus, *L.*	1	R.	sm. rud.	*
Trimeresurus wagleri, *Boie*	1	R.	rud.	
Bothrops atrox, *L.*	1	R.	———	

	Number of specimens examined.	Larger Lung.	Length of the Smaller Lung, that of the larger being taken as unity.
LACERTILIA.			
Fam. SCINCIDÆ [1].			
Acontias meleagris, *L.*	2	R.	♂ ·13; ♀ ·25.
,, monodactylus, *Gray*	1	R.	·40.
Scelotes bipes, *L.*	1	R.	·83.
Fam. ANGUIDÆ.			
Anguis fragilis, *L.*	4	R.	♂ ·62 & ·66; ♀ ·56 & ·96.
Ophisaurus (Pseudopus) apus, *Pall.*	1	R.	·60.
,, ventralis, *L.*	1	R.	·33.
Fam. PYGOPIDÆ.			
Pygopus (Bipes) lepidopodus, *Lacép.*	1	R.	·50 (but of equal stoutness).
Lialis burtoni (punctatus), *Gray*	2	R.	·50.
Fam. TEIIDÆ.			
Ophiognomon abendrothii, *Ptrs.*	1	R.	·50.
Fam. AMPHISBÆNIDÆ [2].			
A. PROSPHYODONTES.			
Amphisbæna alba, *L.*	2	L.	——
,, darwinii, *D. & B.*	1	L.	——
,, fuliginosa, *L.*	2	L.	——
,, ridleyi, *Blgr.*	1	L.	——
Blanus cinereus, *Vand.*	2	L.	sm. rud.
,, strauchii, *Bedr.*	1	L.	rud.
Anops kingii, *Bell*	1	L.	——
Monopeltis magnipartita, *Ptrs.*	1	L.	rud.
Lepidosternon latifrontale, *Blgr.*	1	L.	rud.
,, scutigerum, *Hempr.*	1	L.	rud.
B. EMPHYODONTES.			
Trogonophis wiegmanni, *Kaup*	1	L.	·60.
Pachycalamus brevis, *Gthr.*	4	L.	·25 to ·33.
AMPHIBIA.[3]			
Order GYMNOPHIONA.			
Fam. CÆCILIADÆ.			
Dermophis (Siphonops) mexicanus	1	R.	rud.
Ichthyophis glutinosus	1	R.	rud.

[1] For footnotes, see opposite page.

VII. ON THE RATIONALE OF THE FACTS RECORDED IN THIS PAPER.

Taking these Snakes and Snake-like forms together, the facts noted in this paper are that while some agree with other air-breathing vertebrates in having two lungs well developed, some have one lung quite rudimentary or absent altogether, and that of these latter some have the right lung rudimentary or absent and some the left.

These facts suggest the questions—May we reasonably conclude that in the ancestors of all the different groups of pulmonate vertebrates the lungs were essentially similar in their first origin? If so, what was probably the most primitive condition? What significance may we attach to a divergence from such common condition of the kind above described?

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[1] I have also examined two specimens of *Lygosoma verreauxii.* In the first I was at first surprised to find the right lung apparently shorter than the left (contrary to the rule), but on further inspection I found that this condition was purely pathological, being due to the presence of a small tumour on the anterior border of the right lobe of the liver which interfered with the expansion of the lung. In a second specimen the lungs were of precisely equal length. This equality of the lungs in *L. verreauxii* and occasionally in *Anguis fragilis* (see list) makes me expect that (while the elongated snake-like form and the reduction or suppression of the limbs are commonly associated with the reduction of one lung) the lungs may be found equal in a number of the other elongated small-limbed lizards of which there are so many, especially in the family *Scincidæ.*

[2] J. von Bedriaga (Archiv für Naturgeschichte, 1884, Bd. i. p. 63) finds no trace of a second lung in *Blanus* (*Amph.*) *cinereus* and *B. strauchii* and *Trogonophis wiegmanni*; and C. Smalian (Zeitschrift für wissensch. Zool., Bd. xlii. pp. 188 & 189, 1885) finds no trace of a second in *A. fuliginosa, B. cinereus,* and *Anops kingii,* while as to *Trogonophis wiegmanni* he curiously prefers to regard it as having a bilobed single lung instead of a pair of lungs. Neither Bedriaga nor Smalian, so far as I have discovered, say which lung is well developed, but Bedriaga's figures of *B. cinerea* (*l. c.* pl. iv. figs. 2, 3) rightly represent it as the left.

[3] I have examined other Amphibia, especially the elongated forms with weak limbs and reduction of digits or absence of one pair of limbs (*Siren*); but in none of them can one lung be said to be atrophied as compared with the other. In most of them the two lungs are of equal length [*Siren lacertina, Menobranchus lateralis, Menopoma alleghanense, Salamandra maculosa, Triton cristatus, Amblystoma tigrinum* (fair-sized specimens of Axolotl)]. In a few cases there is a difference in the length. Thus in *Amphiuma* the right lung is the longer, while in *Proteus anguinus,* as is known from the published figures, the left is somewhat the longer, and the same appeared to be the case in some small specimens of Axolotl. These last two can hardly, however, be regarded as exceptions to the general rule, for we cannot say that the right lung is atrophied as compared with the left. Thus each lung of *Proteus* extends back to the ovary or testis, and the fact that the right lung is the shorter depends on the fact that in accordance with a common habit the right reproductive gland is situated further forward than the left. Again, though recording it for form's sake, I hardly think any stress should be laid on the right lung appearing shorter than the left in small (3 inches long) specimens of Axolotl. The lungs are equal in later stages, and the apparent difference in the younger specimens is probably due to the small intestine, which inclines to the right side, presenting the complete expansion of the terminal portion of the right lung, which projects backwards freely beyond the termination of the lung ligament.

The first two questions are very interesting, and I hope shortly to return to their discussion in another paper. For the present I may merely say that I incline to a view similar to that suggested by Goette in 1875, namely that the lungs have arisen from paired lateral branchial pouches [1].

Anyone who adopts this view will recognize a certain tendency to pairedness of the lungs as primitive. It seems, however, highly probable that lungs have arisen [from some such common anlage] independently in the different groups of vertebrates, and that we ought not to conclude that all pulmonate vertebrates are descended from a common pulmonate ancestor. To find such common ancestor we should perhaps have to go back to a time long before the first appearance of pulmonary respiration. It is thus quite conceivable, even accepting Goette's view, that in the ancestors of certain one-lunged types the branchial pouch of one side may have from the first remained rudimentary, that of the other side alone developing into a lung. Such a view is also quite in harmony with embryology; for in the embryos of such forms as *Vipera aspis* and *Typhlops lumbricalis* there is no trace of a second lung even in early stages. While, however, neither embryology nor the theory of homology with paired branchial pouches runs counter to the view that the ancestors of some pulmonates may from the first have had but one lung, while others had two, it seems to me that there are certain facts of comparative anatomy which are in favour of the view that in their first beginning the lungs were not only potentially but actually paired in the ancestors of many species which now have no trace of more than one.

Thus, as is well known, we find cases of two species of Snake which are so alike in other respects as to be classed in the same genus, one of which has a rudiment of the left lung, while the other has no trace of such [2]. Now the pesistence of the rudiment as such a definite structure in the adult, combined with the fact that the rudiment is of proportionally greater size in the embryo, suggest that it is the reduced remains of an organ which was once a functional lung. If, then, a functional lung can be reduced to a mere functionless rudiment, it seems likely, when we find two species of the same genus, one of which has such rudiment while the second has not, that in this second the reduction has but been carried a step farther and that the ancestors of this second, like those of the first, had some trace of a second lung.

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[1] The clue to my reason for taking this view is briefly this, that I find that in the Lizard, Snake, and Bird the œsophagus becomes separated off, from behind forwards, from the anlage of the lungs and from the trachea, just as it would appear from Nestler's observations the anlage of the œsophagus is separated off from the branchial chamber in the metamorphosis of *Ammocœtes* into *Petromyzon* [Nestler, 'Archiv für Naturgeschichte,' Jahrg. lvi. Bd. i. pp. 100–105]. From the best published accounts the same is true of the development of the œsophagus, lungs, and trachea of Amphibia and Mammalia.

[2] Thus in my list above *Crotalus horridus* has a small rudiment, while *C. durissus* has none; *Elaps hygeia* has a rudiment, while *E. fulvius* has none. Similarly, in Cope's paper (7) p. 223, we have such a difference recorded in two other genera besides *Crotalus*, viz. in *Bothrops* and *Ancistrodon*.

Secondly, what significance may we attach to the suppression of one or other lung? Can we, I mean, correlate such suppression with any other anatomical or physiological characters?

As we know, there is, as a rule, on the whole a very distinct bilateral symmetry in the bodies of pulmonate vertebrates, but there is also, as is well known, one marked departure from such symmetry which appears early, with which may, I think, be correlated certain departures from symmetry in some of the other organs. I refer to the marked leaning of the stomach to the left side. Whatever be the cause of this, we have the fact, as also the fact that in the case of these abnormal specimens in which the position of the stomach is reversed there is wont to be a reversed position of the great vascular trunks (the aortic root and the postcaval vein) and other correlated changes. There is, then, evidently a correlation between the asymmetry of the stomach and the asymmetry of some of the other organs; and while in some cases it may be better to say that both are due to some common cause, in other cases (and I think this difference in the size of the lungs one of them) it would seem reasonable to speak of the asymmetry of the stomach as a cause of the asymmetry in the other organ.

From the fact, however, that only some of the animals which have the asymmetrical stomach have unequal lungs, it is obviously not by itself a sufficient cause. The leftward inclination of the stomach and adjoining part of the œsophagus only leads to inequality of the lungs when some second cause, such as the snake-like habit of the body [which naturally renders the accommodation of the viscera a work of greater difficulty], or in mammals some other cause [which I will presently suggest], is superadded.

This view harmonizes with the fact that in the Amphisbænidæ [in which the left lung is the larger] the leftward displacement of the stomach is but small, while the œsophagus is sometimes markedly displaced to the right side. Of course this, as it stands, might suggest that we had here merely a case of mechanical displacement of the œsophagus and stomach by the left lung instead of an obliteration of the right lung by the rightwardly inclined alimentary canal. But in certain of the Amphisbænidæ [e.g. *Amphisbæna alba* and *Anops kingii*, two forms with a total absence of right lung] it is clear that we have something more than this, for though we have no case of "situs inversus" of the postcaval vein, which runs as usual on the right side, we find that the veins from the stomach to the liver are not as usual confined to the median gastro-hepatic ligament, but run in that right dorsal ligament of the liver (the "Hohlvenengekröse" mentioned above, p. 698) which usually carries none but systemic veins, such as the postcaval and vertebro-intercostals. It is at least interesting that this, so far as I am aware unique, feature of the vascular system, which, I take it, argues that the stomach is morphologically more to the right side than usual, should be found in (some, not all of) the Amphisbænidæ, which are also unique in having the right lung partially or completely suppressed[1].

With regard to the lungs of mammals—it has been suggested by some[2] that this inequality is due to the unsymmetrical position of the heart. There are, however, certain considerations which induce me to incline to another view[3]. Firstly, the lungs may, as we have seen, differ markedly in size in reptiles in which the heart is symmetrically situated. Secondly, in the few mammals which I have examined the smaller size of the left pleural space seems to depend not so much on the position of the heart as on the want of symmetry in the mediastinal membranes, whose line of attachment to the diaphragm is a curve sweeping round the left border of the central tendon. Thus perhaps the first cause of the inequality of the lungs here, as in Snakes, may have been the leftward displacement of the stomach,—which cause, however, may have only come into action when, with the development of the diaphragm, the mediastinum came to be *fixed* in its oblique left-sided position. According to this view the unsymmetrical position of the heart would be due to the same cause as the inequality of the lungs, and not be itself the cause of this.

VIII. CONCLUSIONS.

1. In all the Amphisbænidæ examined the right lung is either absent or smaller than the left.

2. In all the other vertebrates examined the right lung is fully developed, and if one lung is rudimentary or absent, it is the left. Thus ———

3. The left lung is the smaller in many mammals, and more markedly so in the Gymnophiona and many snake-like Lizards [not Amphisbænidæ] and Snakes, in which last the left is usually reduced to a mere rudiment or absent altogether.

4. In the more theoretical section VII. I incline to the view that in their first beginnings the lungs were in the ancestors of all air-breathing vertebrates potentially paired, having their origin in paired branchial pouches, and show reason to believe that they were actually paired in the ancestors of at least some forms which show no trace of a second.

5. It would seem that the primary cause of the inequality of the lungs, where it occurs, is that one-sided displacement of the stomach and adjoining portion of the œsophagus which is seen in

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[1] To avoid needless repetition, other remarks which naturally might follow here are placed only in the next section (Conclusions 5 and 6)

[2] G. L. Duvernoy, 'Leçons d'Anat. comp. de G. Cuvier,' 2nd ed. tom. vii. pp. 20, 24, 25 (1840).
R. Owen, 'Anatomy of Vertebrates,' vol. iii. p. 577 (speaking of Marsupials) (1868).

[3] I refer only to the leftward displacement of the ventricle. I do not dispute the fact that in most mammalian lungs we note that the left bronchus appears the longer, owing apparently to the fact that the one-sided development of the aortic root has entailed the suppression of part of the left lung in that region.

nearly all air-breathers, but that this only leads to inequality when some secondary cause, such as the acquisition of a slender snake-like habit of body (or in mammals some other cause, see § VII.), is superadded. Moreover, it would appear that in some cases (as in most Snakes), the inequality once started, the replacement of paired lungs by one larger one has in its turn led to a further displacement of the alimentary canal and other organs.

While thus suggesting an order of priority for correlated modifications, the writer does not lose sight of the fact that these modifications have all arisen under the supervision of Natural Selection, and that the safest and most philosophical course is simply to say that the aggregate of modifications are in some way more or less advantageous.

6. The question occurred to me whether the complete or partial suppression of the right lung peculiar to Amphisbænidæ might serve to tell us anything as to the stage in their evolution at which the Amphisbænidæ branched off from the stock common to them and other Lizards—whether, for instance, it might indicate that they branched off before their common ancestors had acquired lungs, at a time, therefore, when perhaps the respective ancestors of existing Lacertilia and Amphibia had diverged comparatively little

However, on consideration it seems clear that the facts here recorded do not by themselves prove any such thing, and that they are not by themselves inconsistent with a considerably later separation of the Amphisbænians.

7. This peculiarity of the Amphisbænian lungs is for the present, then, but one added to the list of the peculiarities of these very interesting animals; but the fact that (so far I have been able to ascertain) no other vertebrate has the right lung suppressed, suggests that this at first sight unimportant character may be found to be correlated with some other character the significance and importance of which may be more obvious.

IX. Bibliography[1].

(1) Chr. Lud. Nitzsch. De Respiratione Animalium, p. 13. Vitebergæ, 1808.
(2) J. F. Meckel. "Ueber die Respiration der Reptilien." Deutsches Archiv für die Physiologie, Bd. iv. pp. 60–89 [especially p. 84] and plate 2 [of which the explanation is given at the end of Heft 1, pp. 162–164]. Halle, 1818.
(3) J. F. Meckel. System der vergleichenden Anatomie, Bd. vi. pp. 257–262 [especially pp. 257 and 260]. Halle, 1833.
(4) Leçons d'Anatomie comparée de Georges Cuvier, rédigées et publiées par G. L. Duvernoy. 2nd ed., tom. vii. pp. 19–163. Paris, 1840.

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[1] Milne-Edwards (6) refers to a separate paper by Lereboullet entitled 'Anatomie comparée de l'appareil respiratoire.' None of the London Libraries accessible to me possess a copy of this paper; so I have not been able to see it, and consequently do not put it on the list, but it is possibly quite as worthy of a place there as some of the others.

(5) H. Stannius. 'Handbuch der Anatomie der Wirbelthiere' [2nd part of the 'Handbuch der Zootomie' by v. Siebold and Stannius]. 2nd ed. 2nd part, pp. 206–208 [with their footnotes]. Berlin, 1856.

(6) H. Milne-Edwards. Leçons sur la Physiologie et l'Anatomie comparée de l'Homme et des Animaux. Tom. ii. pp. 307–313 [and their footnotes]. Paris, 1857.

(7) E. D. Cope. "On the Lungs of Ophidia." Proc. Amer. Phil. Soc. vol. xxxiii. pp. 217–224, pls. xi.–xvi. 1894.

(8) E. D. Cope. "On the Classification of Snakes." Amer. Naturalist, Oct. 1894, pp. 831–844, pls. xxvii. & xxviii.

X. EXPLANATION OF PLATE XL.

A.	Artery.
Ao.	Dorsal aorta.
Œsoph.	Œsophagus and anterior part of stomach.
Rt. & Lt.	Right & Left.
V.	Vein.
V.c.p.	Vena cava posterior.
V.P.	Portal vein.

Fig. 1. Heart, lungs, œsophagus, and anterior part of liver of *Heterodon platyrhinus*, seen from ventral side.

Figs. 2, 3, and 4. Transverse sections of *H. platyrhinus*, seen from behind.—Fig. 2 through heart; Fig. 3 through fork of trachea and left lung Fig. 4 through liver-region.

Figs. 5–9. Transverse sections of different Snakes through liver-region, all seen from behind:—

Fig. 5. *Platurus laticaudatus.*
Fig. 6. *Python reticulatus.*
Fig. 7. *Tropidonotus natrix.*
Fig. 8. *Vipera berus.*
Fig. 9. *Dryophis prasinus.*

Fig. 10. Semidiagrammatic view of part of trunk of a two-lunged Snake. The right-hand end, which is seen in section, is the posterior end. The body-wall of the left side is supposed cut away so as to show the various series of blood-vessels which run between the vertebral column and the liver, separating the two lungs.

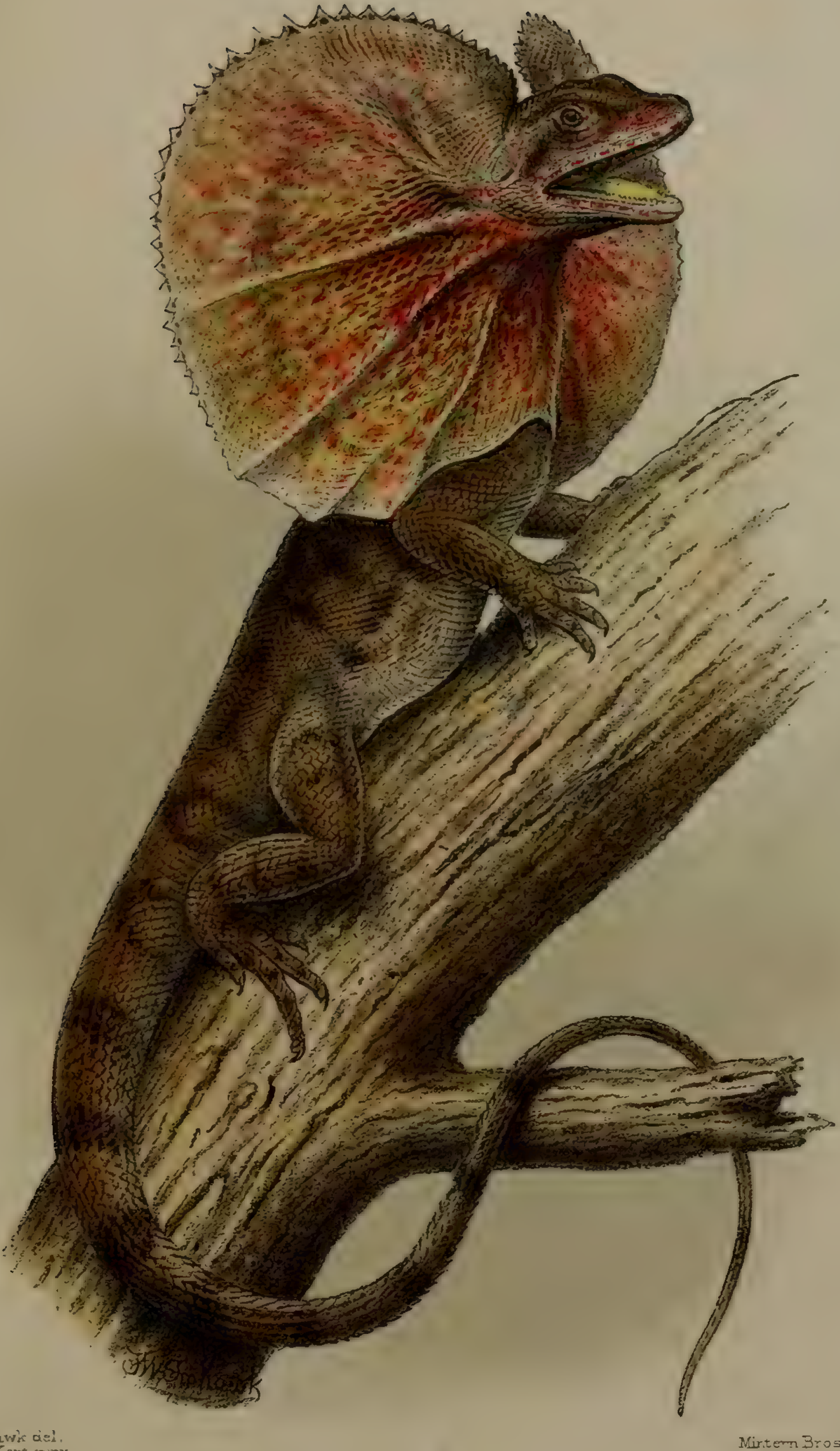
2. Observations on the Frilled Lizard, *Chlamydosaurus kingi*.

By W. Saville Kent, F.L.S., F.Z.S., &c.

[Received October 23, 1895.]

(Plate XLI.)

The Frilled Lizard, *Chlamydosaurus kingi*, is a native of the Northern or tropical districts of Australia, occurring in tolerable abundance in both the Eastern, or Queensland, and the North-western districts of that island-continent. The habits of the species are essentially sylvan, its favourite haunts being the more or less thickly wooded scrub-lands, and its chief resort the trunks and lower limbs of the larger trees. The most remarkable structural feature of *Chlamydosaurus*, and from which it derives its popular title, is, as recorded in its earliest description by Dr. J. E. Gray in the Natural History Appendix to Captain King's 'Survey of the Coasts of Australia,' vol. ii. 1826, the extraordinary development of the cuticle in the neighbourhood of the neck,



F.W. Frohawk del.
W. Saville-Kent pinx.

Mintern Bros. Chromo.

CHLAMYDOSAURUS KINGI.

This takes the form of a voluminous denticulated frill, which the creature possesses the power of erecting and depressing at will. In adult individuals, the frill, when fully extended, may measure as much as eight or nine inches in diameter, and diverges at right angles to the long axis of the head. When depressed the structure is relatively inconspicuous, being folded in symmetrical pleats around the creature's neck (see fig. 2, p. 717).

The possession of living examples of *Chlamydosaurus*, both in Queensland and, more recently, in Western Australia, has yielded me the opportunity of observing and placing on record certain phenomena associated with its habits that are scarcely less remarkable than its structural peculiarities. Having, moreover, succeeded in bringing one of these singular Lizards alive to England, I had much pleasure in presenting the specimen to this Society's Gardens, where others specially interested in this animal group have been afforded opportunities of verifying the observations embodied in this communication.

In the first place, with reference to the elevation and depression of the membranous frill, *Chlamydosaurus* is not unfrequently delineated in natural-history works with this structure more or less fully extended, but with the mouth completely closed. I have also observed mounted specimens in museums displaying a corresponding relationship of the organ and structure indicated. As a matter of fact, the opening of the mouth and the erection of the frill are synchronous actions which cannot be exercised independently of one another. An explanation of this circumstance is afforded by the presence of slender processes of the hyoid bone which extend on either side through the walls of the membranous frill. The relative elevation of the frill is consequently in a direct proportion with the depression of the mandible, and it is only under the condition of the mouth being opened to its widest extent that the frill is so conspicuously displayed as to stand out at a right angle from the animal's neck, as illustrated in the drawing now exhibited (Plate XLI.)

With regard to the significance and utility of the erectile frill in *Chlamydosaurus*, the fact that this structure is of insignificant proportions in young examples, and attains its full development only in adult individuals, would appear to indicate that, as a structure, it has been developed within comparatively recent times and does not represent the residual heritage of a remote ancestry. Respecting its function, there can, I think, be but little doubt that it fulfils simply the *rôle* of a "scare-organ," wherewith, being suddenly erected, it terrifies, and diverts the projected attack of, many ordinary enemies. The erection of the feathers of an owl or the fur of a cat is associated with a like function, but the inflation of the hood of the Cobra, and in a less degree the neck-membranes of other snakes, furnishes, perhaps, a more appropriate analogy. In one other Australian species, *Amphibolurus barbatus*, commonly known as the Jew Lizard, the throat membrane is also inflated under the influence of irritation in such a manner as to almost constitute a frill. It is on this account, in districts south of the habitat of *Chlamydosaurus*, not unfrequently associated with the corresponding popular name of the Frilled Lizard.

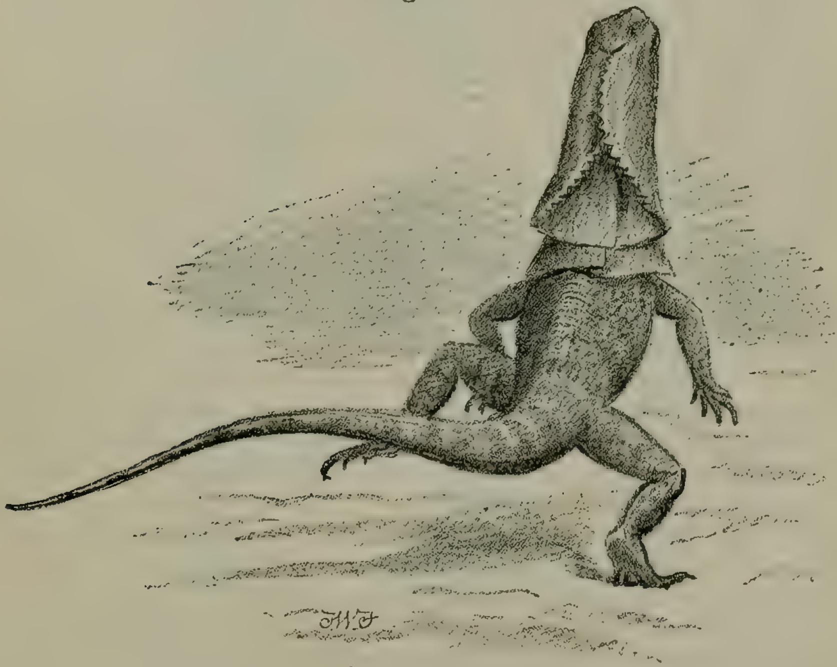
With respect to the natural food of *Chlamydosaurus*, I observed of all the living specimens that came into my possession that the excreta evacuated during the first few days after their capture consisted exclusively of the elytra and other hard parts of Coleoptera, such insects evidently constituting their customary food. One or two of the specimens captured would occasionally take a living cockroach, picking it up with the protrusion of its fleshy glutinous tongue. It was not found possible to induce any of the captured examples to take other than living food voluntarily, but on very slight provocation they would open their mouths, and on pieces of raw meat being then placed inside them they masticated and swallowed it with apparent relish, and throve for many weeks on this artificially substituted diet.

Individual specimens of *Chlamydosaurus* exhibited a considerable diversity of temperament—some of them being exceedingly quiet, and others, males more particularly, most distinctly aggressive. One or two examples, when first captured, would, when approached, spring up and seize any presented object. What was more remarkable, however, was the general habit they manifested, if much excited, of standing at bay with open mouths and erected frills, uttering a hoarse, hissing noise, and lashing whip-wise at the intruder with their long, rough tails. The blows thus delivered were dealt with such vigour as to smartly sting the hand if exposed to the impact. The flagellating method of attack manifested by this Lizard no doubt proves very disconcerting to a foe previously unfamiliar with the animal's peculiar aggressive tactics.

The habits of *Chlamydosaurus* were found to be essentially diurnal—all the specimens kept in captivity retiring to rest on the approach of sunset, usually choosing for this purpose a vertical position, head uppermost, at the side of their cage or on an introduced tree-stump. The living specimens exhibited some amount of individual variation in colour, and more especially with relation to the membranous frill. The lower moiety of this structure was always more brightly coloured than the integument of the general surface of the body, and, in the males more particularly, was ornamented with a mosaic-like pattern in which orange, vermilion, steel-blue, and shades of brown were variously interblended. These tints, unfortunately, usually fade out of preserved skins, but in some instances faint indications of their original variegation may be retained. The coloured illustration that accompanies this communication (see Plate XLI.) has been reproduced from a water-colour sketch from life made by me of a Roebuck Bay example, amalgamated with an excellent lithograph of the animal that appeared in the issue of the 'Field' quoted below.

The most remarkable phenomenon concerning the habits of *Chlamydosaurus* that I have to place on record in this communication relates to its method of perambulation. In this respect it would appear to differ from all existing Reptilia known to science. When in Queensland a few years ago it was reported to me that the animal could run supported upon its hind legs only. By others, however, this assertion was contradicted, and neither was I successful in witnessing this most remarkable phenomenon of the single living specimen I there had in my possession for a short period. With examples obtained at Roebuck Bay, in the tropical district of Western Australia, I was more fortunate, and was enabled to fully satisfy myself that a bipedal mode of progression represents its normal gait when the animal is traversing level ground for any distance. In addition to having had the gratification of securing other independent witnesses of the remarkable method of locomotion exhibited by *Chlamydosaurus*, I have also succeeded in obtaining several characteristic photographs, herewith submitted, of this Lizard thus running. From one of the most typical of these photographs the skilful taxidermist, Mr. Pickhardt, has prepared the specimen likewise exhibited, and which will serve to convey a yet more realistic impression of the aspect of the running animal[1].

Fig. 1.



The Frilled Lizard running.

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[1] By the kind courtesy of the proprietors of the 'Field' the woodcut (Fig. 1) executed in accord with one of these photographs, drawn from life at the Zoological Gardens by Mr. Frohawk, and which appeared with a preliminary notice of this lizard in that journal for August 3rd, is herewith reproduced. The writer is likewise indebted to the same source for Fig. 2 (p. 717), representing the animal in its ordinary resting attitude when on the ground.

Concerning the erect bipedal method of perambulation of *Chlamydosaurus*, it is worthy of remark that during such progress the fore limbs hang lax and motionless, while the long, slender tail is elevated quite clear of the ground, and, swaying slightly from side to side, plays apparently an important part in preserving the animal's equilibrium[1].

By experimentally tethering examples of this Lizard to light cords in such a manner that they possessed full freedom of action, I ascertained that they will run for a distance of at least thirty or forty feet at a stretch without touching the ground with their fore feet, and then, after resting momentarily on all fours, will make a new start in the erect position, and thus continue running and resting alternatively for a period of some minutes' duration. Although no other existing species of lizard is known to possess a similar faculty of perambulating upon its two hinder limbs, it is perhaps worthy of record that I have often observed of Australian species of *Grammitophora* that when running they carry their heads erect in the air, at the same time sitting up, as it were, on their haunches, and with the whole anterior portion of their bodies raised to the greatest possible height by the full extension of their anterior limbs. A similar semi-erect or "sitting-up" position is also, I may observe, usually assumed by the Frilled Lizard, *Chlamydosaurus*, when resting on the ground (see Fig. 2, p. 717), and when running for so short a distance only as two or three yards. The progress of *Chlamydosaurus* in its most characteristic bipedal fashion is tolerably rapid, insomuch so that it was found impossible to obtain a distinct photographic picture of a specimen under such conditions at a distance of four or five yards with a Kodak camera having its shutter working at a speed of the $\frac{1}{100}$th part of a second, and it was only by enlisting the aid of an Anschutz camera with a shutter set at the speed of the $\frac{1}{500}$th part of a second that the results here reproduced were secured. Even under these more favourable conditions I was unable to obtain as clearly defined a profile representative of the running lizard as might be desired. Among those secured, however, there is one (submitted) remarkable for the resemblance that the contours of the semi-erect body and ambulatory hind limbs bear to those of a running long-tailed gallinaceous bird such as a pheasant.

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[1] Since the setting-up in type of this paper I am indebted to the Secretary for a previous reference to the reported bipedal comportment of *Chlamydosaurus*. This is made by Dr. Henry Woodward in vol. xxx. p. 13 of the Quarterly Journal of the Geological Society, 1874. By a happy coincidence that accomplished geologist, in company with Dr. Günther, overheard the comments of an Australian visitor to the British Museum on a stuffed specimen in the collections, and they were informed that this species habitually ran on its hind legs. Dr. Woodward utilizes this and collateral evidence presented extensively in his paper here quoted, which is an amplification of Prof. Huxley's essay on "Animals intermediate between Birds and Reptiles" ('Popular Science Review,' 1866), and bears practically the same title. Dr. Woodward's concluding paragraph, to the effect that "the bipedal habit of the Secondary Reptiles is a peculiarity still maintained by the Australian *Chlamydosaurus*," is of special interest with reference to the latter portion of this paper.

In corroboration of this suggested simile, I may further mention that in the course of a recent conversation with Mr. R. C. Hare, for some time Government Resident at Wyndham in the northern district of Western Australia, that gentleman informed me that he had on several occasions, when these Lizards crossed his path,

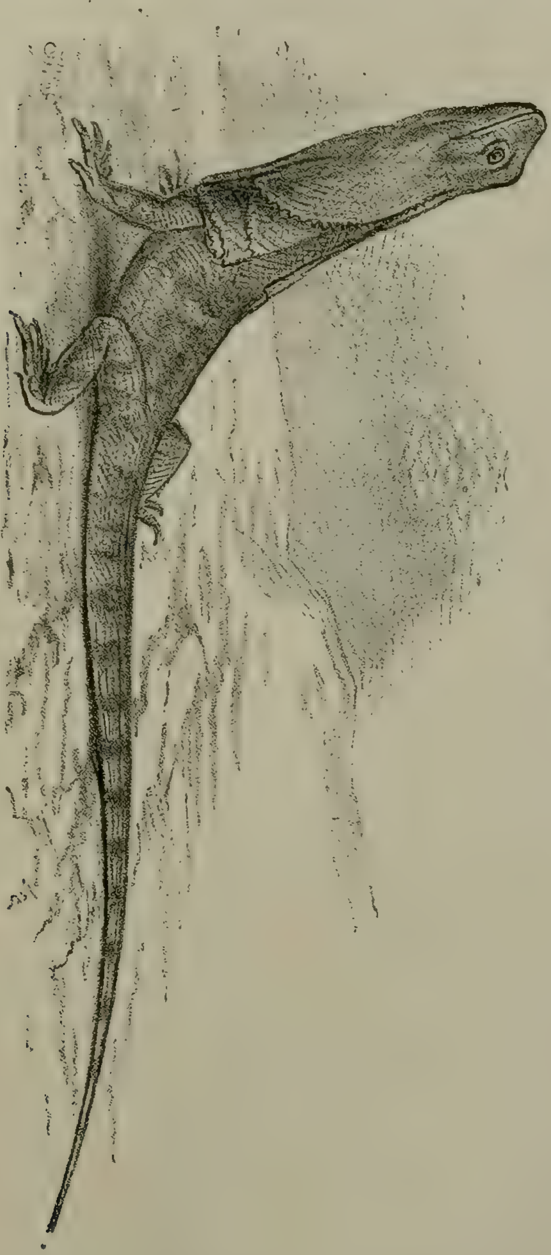


Fig. 2.

The Frilled Lizard at rest.

noted the remarkable resemblance their gait presented to that of a running hen.

This recognized avian-like ambulatory deportment of *Chlamydosaurus* is of special interest with reference to the very generally accepted anticipation that the birds are modified descendants of a reptilian archetype. The temptation in this association is naturally also very great to institute comparisons between, and to suggest affinities with, the Mesozoic Dinosauria, among the majority of which extinct reptilia a bipedal method of progression constituted, there is every reason for believing, a characteristic feature. The very circumstance, indeed, that the Australasian region, inclusive of New Zealand, produces an existing Lizard with such ancient affinities as *Hatteria*, and the Australian Continent a living freshwater fish, *Ceratodus*, most abundantly represented in the Triassic and Oolitic formations, as also a number of mammalia and other organic types elsewhere extinct, it might certainly be reasonably anticipated that a Lizard with Dinosaurian affinities, if existing anywhere at the present day, might be sought for with the greatest prospect of success upon Australian territory.

An examination of the skeleton of *Chlamydosaurus* does not, certainly, as hopefully anticipated, yield indications of that modification of the pelvic elements which is so characteristic of the most specialized Dinosauria; nor, indeed, any salient features that serve to distinguish it amongst the Lacertilia from the skeletons of the ordinary Agamidæ. It would seem imprudent under these circumstances to institute other than comparisons of mere accidental and independently arrived at analogies between the coincident erect comportments and corresponding external resemblances exhibited by the types under discussion. These resemblances appear, however, with relation to certain types to be sufficiently remarkable as to invite brief notice.

The order of the Dinosauria or Ornithoscelida, as at present recognized, embraces very widely divergent forms of Reptilia. Some of them possess distinctly Avian and others Lacertilian affinities, while in a third group the modification is in the direction of huge brute-like forms emulating or surpassing the Rhinoceros in form and bulk. It is not proposed here to institute comparisons between *Chlamydosaurus* and such Dinosaurian types as *Iguanodon*, with its three-toed bird-like feet and ponderous trailing tail, or with the colossal Rhinoceros-headed *Triceratops* of Marsh and its allies. Within the Lacertilian section of the Dinosaurs there are, however, several described types between which and the Australian *Chlamydosaurus* there is by no means such a wide gulf fixed. Notably among these, reference may be made to the *Anchisaurus colurus* of Marsh, of which a figure and description are given in the 'Geological Magazine,' dec. iii. vol. x., April 1893. This form is referred to by its describer as representing "one of the most slender and delicate Dinosaurs yet discovered." Its total length did not exceed six feet, and the most remarkable feature possessed by it, as attested by Marsh, and in which respect it "apparently differed from any other Dinosaur previously described," was associated with the circumstance that "its tail was quite slender and flexible, and evidently usually carried free from the ground."

It is further worthy of note that in Marsh's figure above quoted the pelvis of *Anchisaurus* is represented as corresponding more nearly with that of existing Reptilia than with that of the more typical Dinosauria. The prolongations of the ilia in front of the acetabula are relatively short, while the pubes are directed distinctly downwards and forwards like those of all ordinary Lacertilia.

The Dinosaurian type most worthy of attention in correlation with *Chlamydosaurus* is the *Compsognathus longipes* of A. Wagner yielded by the lithographic stones of Solenhofen. An admirable cast from the type specimen, which is almost perfect, is also on view in the Geological Department of the Natural History Museum. In size, in the slender character of the entire skeleton, and in the relative proportions of the fore and hind limbs, it is almost a counterpart of *Chlamydosaurus kingi.*

In a notable essay, entitled "Animals which are most nearly intermediate between Birds and Reptiles," contributed to the 'Popular Science Review' in the year 1866, the late Professor Huxley makes a special reference to *Compsognathus.* He says in allusion to it, "It is impossible to look at the conformation of this strange Reptile and to doubt that it hopped or walked in an erect or semi-erect position after the manner of a bird, to which its long neck, slight head, and small anterior limbs must have given it an extraordinary resemblance."

Referring to this same type in his 'Anatomy of Vertebrated Animals,' ed. 1871, p. 262, Professor Huxley remarks:—"The pubes of *Compsognathus*, unfortunately obscured by the femurs, seem to have been very slender, and to have been directed forwards and downwards like those of Lizards. Some Lizards in fact have pubes which, if the animal were fossilized in the same position as *Compsognathus*, would be very similar in form and structure." And again on page 263:—"It remains to be seen now how far the Hypsilophodont (Avian) modification of the pelvis extended among the Ornithoscelida (Dinosauria). The remains of *Compsognathus* and *Stenopelyx* tend to show that it was by no means universal."

All things considered, *Chlamydosaurus* would appear to present, in virtue of its erect gait, as distinct a divergence from among the Lacertilia in the direction of certain of the Dinosauria, as do some members of the last-named group towards that of the ordinary Lizards, leaving between the two a by no means immeasurable hiatus. Whether or not the remarkable locomotive comportment of *Chlamydosaurus* here recorded has been transmitted by heredity from a lizard-like Dinosaurian ancestor, such as *Compsognathus*, or has been redeveloped independently among the Agamidæ, may be commended to the consideration of the herpetological expert.

3. On a small Collection of Butterflies made by Consul Alfred Sharpe at Zomba, British Central Africa. By ARTHUR G. BUTLER, Ph.D., F.L.S., F.Z.S.

[Received August 2, 1895.]

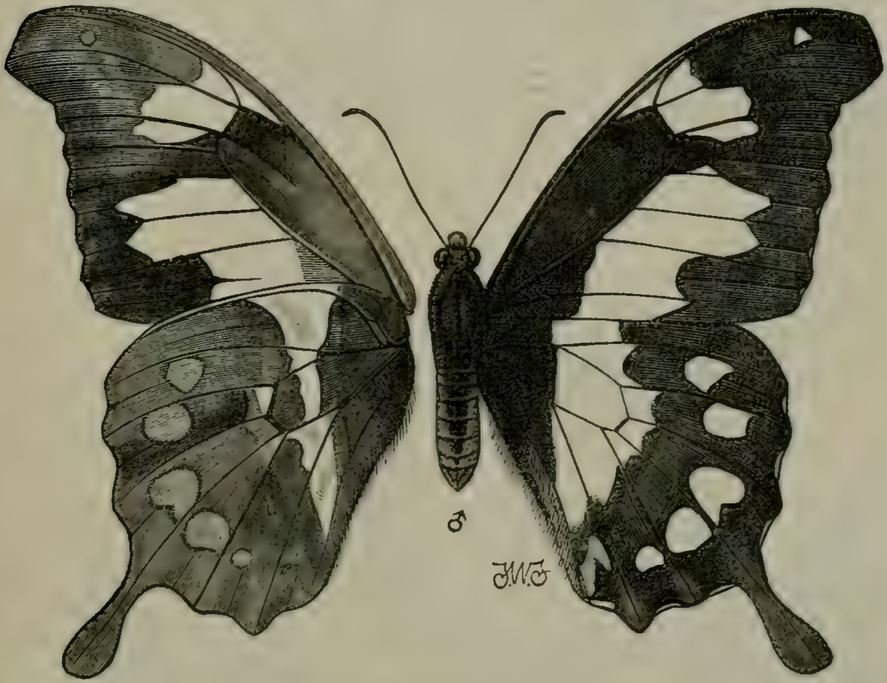
The present collection, brought home by Consul Alfred Sharpe on his recent return from Nyasaland, was forwarded to me by our Secretary, with permission to select such specimens as were required for the Museum series. Among the specimens is an example of a fine new species of *Papilio*, which I here describe.

The following is a list of the species of which examples were obtained: it will be seen that, as usual from this locality, the genus *Charaxes* is well represented:—

1. Amauris whytei, *Butler.*
2. ,, dominicanus, *Trimen.*
3. Limnas chrysippus, *Linn.*
4. Eurytela dryope, *Cramer.*
5. Charaxes brutus, *Cramer.*
6. ,, druceanus, *Butler.*
7. ,, pollux ♀, *Cramer.*
8. ,, saturnus, *Butler.*
9. ,, guderiana, *Dewitz.*
10. ,, ethalion, *Boisd.*
11. ,, whytei, *Butler.*
12. ,, lasti, *Grose-Smith.*
13. ,, leoninus, *Butler.*
14. ,, cithæron, *Felder.*
15. ,, bohemani, *Felder.*
16. ,, eupale, *Drury.*
17. Euralia wahlbergi, *Wallengr.*
18. ,, mima, *Trimen.*
19. Junonia tugela ♂, *Trimen.*
20. ,, cuama, *Hewits.*
21. ,, clelia, *Cramer.*
22. ,, boopis, *Trimen.*
23. ,, sesamus, *Trimen.*
24. ,, artaxia, *Hewits.*
25. Pyrameis cardui, *Linn.*
26. Protogoniomorpha anacardii, *Linn.*
27. Euphædra neophron, *Hopff.*
28. Pseudargynnis duodecimpunctata, *Snellen.*
29. Crenis boisduvalii, *Wallengr.*
30. Neptis agatha, *Cramer.*
31. Atella columbina, *Cramer.*
32. Argynnis smaragdifera ♀, *Butl.*
33. Acræa cabira, *var.* apecida, *Oberth.*
34. ,, oncæa ♀, *Hopff.*
35. ,, buxtoni, *Butler.*
36. ,, sganzini, *Boisd.*
37. ,, natalica, *Boisd.*
38. ,, acrita, *Hewits.*
39. ,, areca, *Mabille.*
40. ,, guillemei, *Oberth.*
41. Mylothris agathina, *Cramer.*
42. Terias regularis, *Butler.*
43. Catopsilia florella, *Fabr.*
44. Papilio policenes, *Cramer.*
45. ,, corinneus, *Bertol.*
46. ,, demoleus, *Linn.*
47. ,, bromius, *var.* brontes, *Godman.*
48. ,, erinus, *Gray.*
49. ,, pelodurus, sp. n.
50. Tagiades flesus, *Fabr.*
51. Proteides erinnys, *Trimen.*
52. Nephele funebris, *Fabr.*
53. Pleretes thelwalli, *Druce.*
54. Patula walkeri, *Butler.*

PAPILIO PELODURUS, sp. n.

♂. Allied to *P. horribilis.* Wings black, brownish at base, with golden-brown tails; markings of primaries cream-coloured traversed by black veins, similar in disposition to those of *P. horribilis*, but the oblique bar beyond the cell and discal belt much broader, more uniform in width, the discal belt also emitting a triangular spur above the third median branch: secondaries with the transverse belt half as wide again, extending well beyond the end of the cell; the discal spots also larger; a broad Λ-shaped orange-ochreous marking above the anal angle and a paler ochreous marginal lunule below it; other marginal lunules between the veins lemon-yellow; sides of body argillaceous: under surface of wings nearly as in *P. horribilis*, but the pale areas more copper-coloured; the creamy bar and belt of primaries nearly as above, the tapering band across the secondaries slightly different in outline and more prominent, two well-defined triangular whitish spots at base of second median and upper radial interspaces: pectus and legs as in *P. horribilis*. Expanse of wings 110 millim.



Papilio pelodurus.

One male specimen only was obtained, but Mr. Aurivillius, whose wide experience in African Lepidoptera gives great weight to his opinion, agrees with me that it is a representative of an entirely new and very beautiful species. I should have liked to dedicate this *Papilio* to its discoverer, but I am afraid that the name has been already employed.

4. On Lepidoptera recently collected in British East Africa by Mr. G. F. Scott Elliot. By Arthur G. Butler, Ph.D., F.L.S., F.Z.S., &c.

[Received August 8, 1895.]

(Plates XLII. & XLIII.)

The present collection was received in two consignments, the first and most important set having been already worked out, and the bulk of the present article written, before the second series was received; it was, however, thought advisable to incorporate the latter, which added only fifteen species to the collection, rather than to put them in as an appendix.

The majority of the butterflies obtained by Mr. Scott Elliot belong either to the *Nymphalidæ* or *Papilionidæ*. Six butterflies and four moths are recognized as new, viz.:—

Amauris ellioti (previously described), p. 723.
Mycalesis aurivillii, p. 724.
Junonia pyriformis, p. 726.
  ,, *gregorii* (also obtained by Dr. Gregory), p. 726.
Argynnis excelsior, p. 729.
Mylothris croceus, p. 734.
Xanthospilopteryx hypercompoides, p. 739.
Callarctia ellioti, p. 739.
Malacosoma? *thoracica*, p. 740.
Heterabraxas roseovittata, p. 741.

Among other species of interest obtained, two rare forms of *Papilio* (*P. mackinnoni* and *P. jacksoni*) are specially worthy of note.

Although many of the specimens in this collection are unfortunately not in good condition, they are, in almost every instance, sufficiently well preserved for satisfactory determination, and will be of considerable value as an aid to our knowledge of the geographical distribution of African Lepidoptera.

The following species were obtained:—

RHOPALOCERA.

1. AMAURIS DAMOCLES.

Papilio damocles, Beauv Ins. Afr. Am. p. 239, pl. 6. figs. 3 *a*, *b* (1805).

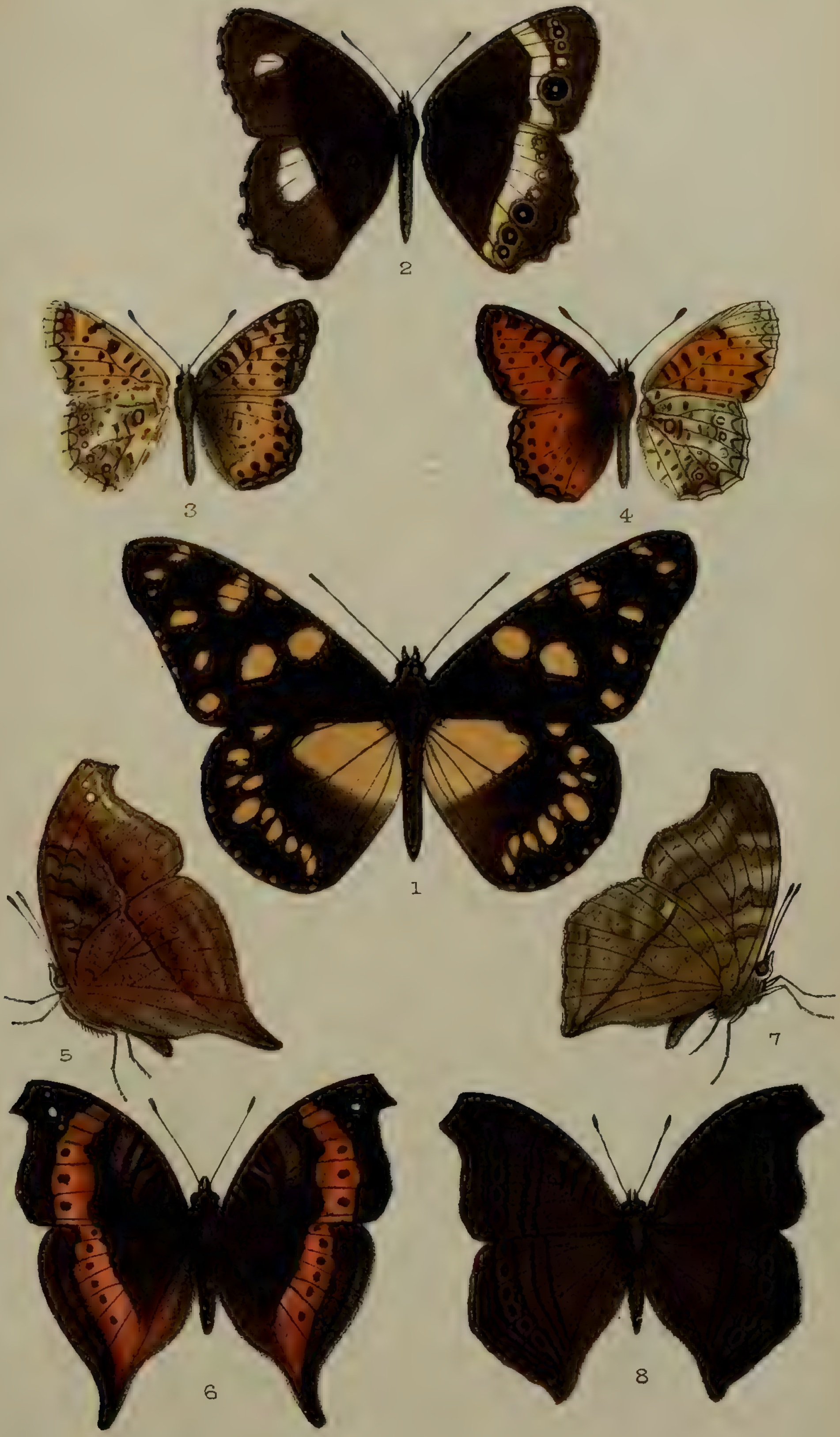
Kampala and Uganda, Feb. 1894.

2. AMAURIS ALBIMACULATA.

Amauris echeria, var. *albimaculata*, Butler, Ann. & Mag. Nat. Hist. ser. 4, vol. xvi. p. 394 (1875).

Ruwenzori: ♂, between Kivata and Wimi, in May or June, at

P.Z.S.1895. Plate XLII.

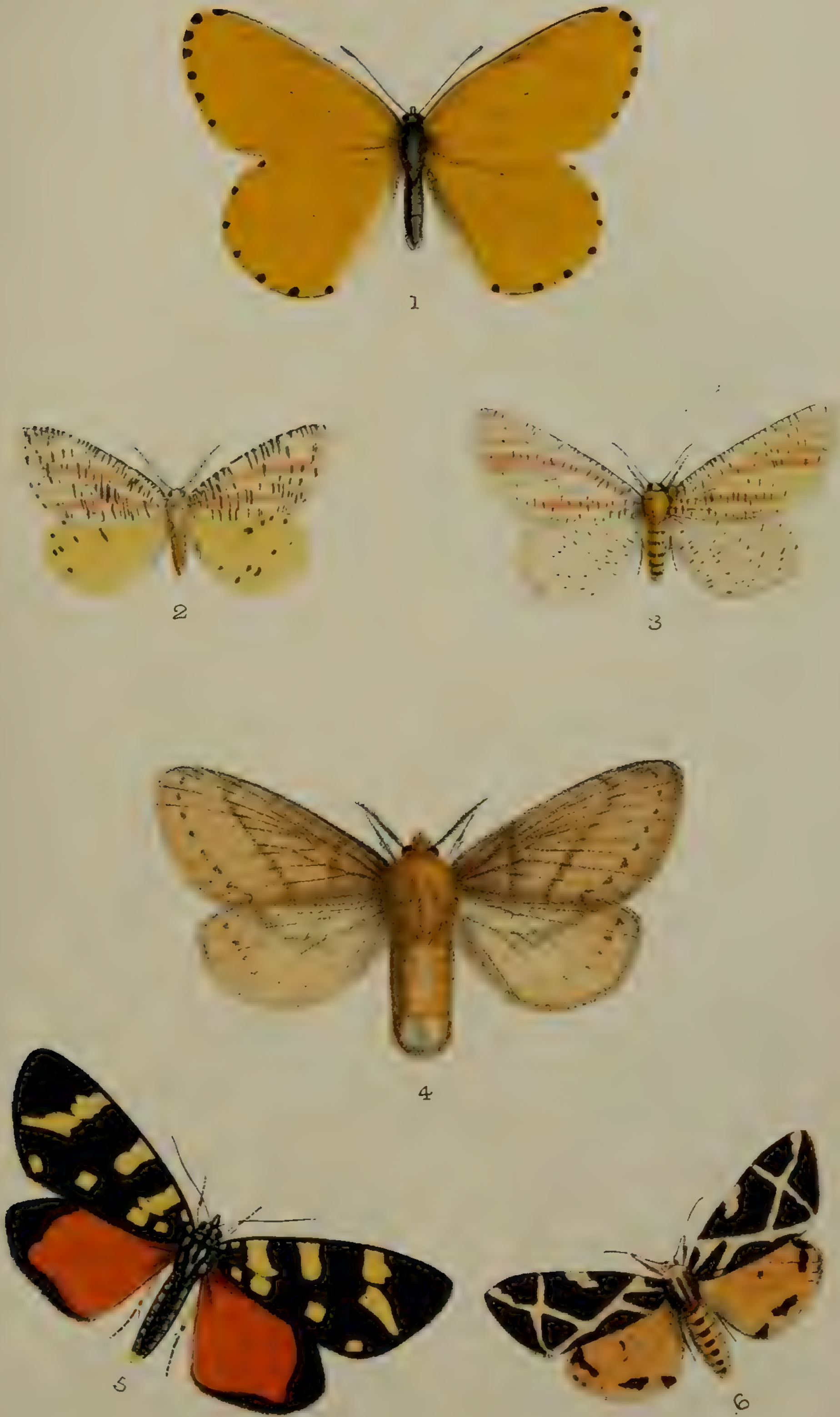


F.W.Frohawk del.et lith.

West,Newman chromo.

New Lepidoptera from British E. Africa.

P. Z. S. 1895. Plate XLIII.



F.W.Frohawk del. et lith.

West, Newman chromo.

New Lepidoptera from British E. Africa.

BRITISH MUSEUM NATURAL HISTORY

an elevation of 7000–8000 feet; ♀, Kazamaza's, between the 18th and 23rd April, at 5300 feet.

These examples are not quite typical, the spot in the cell of the primaries being elongated into an oblique bar, and the dark external area of the secondaries being distinctly wider; but, without more material, it would be rash to assert that this was a distinct local race; the form of the male is that of typical *A. echeria* rather than of *A. albimaculata*.

3. AMAURIS ELLIOTI. (Plate XLII. fig. 1.)

Amauris ellioti, Butler, Ann. & Mag. Nat. Hist. ser. 6, vol. xvi. p. 122 (1895).

♂ ♂, Salt Lake to Wawamba country and Ruwenzori, 5600 feet. A very well-defined distinct species, with hind-wing characteristics of the genus *Tirumala*.

4. LIMNAS CHRYSIPPUS.

Papilio chrysippus, Linnæus, Mus. Lud. Ulr. p. 263 (1764).

♂ ♂, Salt Lake to Wawamba country; Berkeley Bay.

A female of the variety *L. klugii* was also obtained at Uganda, and a male from Berkeley Bay, Victoria Nyanza, obtained Jan. 12th, 1894.

5. MYCALESIS TECHNATIS.

Mycalesis technatis, Hewitson, Exot. Butt. v., *Myc.* pl. x. fig. 67 (1877).

♂ ♂, Kazamaza's, Ruwenzori, 5300 feet, 13th to 23rd April.

The ocelli are smaller than in the type, but otherwise there seems to be no difference; *M. campa*, Karsch, seems to be the same species.

6. MYCALESIS VULGARIS?

Mycalesis vulgaris, Butler, Cat. Sat. Brit. Mus. p. 130, pl. 3. fig. 2 (1868).

♂ ♂, Kivata, 6000–8000 feet; ♀, Kazamaza's, Ruwenzori, 5300 feet. Also worn examples from Uganda.

So far as it is possible to trace the pattern on these very worn specimens, it corresponds exactly with that of *M. vulgaris*; there can therefore be very little doubt as to the correctness of the identification. A shattered and rubbed example of *M. evenus*, Hopff., was obtained on the Victoria Nyanza, and a slightly better example from Malamba, 7000 feet, on the 13th January.

7. MYCALESIS MATUTA.

Mycalesis matuta, Karsch, Ent. Nachrichten, xx. p. 228, no. 10 (1894).

Salt Lake to Wawamba country.

I have to thank Prof. Aurivillius for referring me to the description of this beautiful species.

8. MYCALESIS AURIVILLII, sp. n. (Plate XLII. fig. 2.)

Allied to *M. saussurei*, Dewitz. Above deep olive-brown, basal three-fifths of primaries and basal four-sevenths of secondaries decidedly darker than the rest of the surface; partly bounding the dark basal area of the primaries is a large oblique 8-shaped patch, its upper portion pale brown, its lower portion pure white, with brownish edging: secondaries having the upper half of the dark basal area bounded externally by a large quadrifid pure white wedge-shaped half-band; fringes whitish between the nervures: body blackish; antennæ black, ringed with white. Under surface with dark basal area as above, bordered externally by a sharply defined belt of cream-colour; external area paler and greyer than above, with a diffused blackish submarginal line and an ill-defined wavy discal line immediately after the ocelli: primaries with six ocelli—the first indistinct, second and fourth small, black, white-pupilled, with dull yellowish iris, third similar, but larger; fifth little more than a white spot, sixth well-defined and much the largest: secondaries with seven ocelli—the first three small, black, white-pupilled, the third with whitish iris, fourth a white spot with sordid edging, fifth to seventh large and conspicuous, the fifth being largest and the sixth and seventh connate; these ocelli are black, white-pupilled, with yellowish iris: body below dark brown; palpi with a whitish line at the base of the fringes. Expanse of wings 46–48 millim.

Ruwenzori, 5600 to 9000 feet.

I have named this very striking and distinct species in honour of Prof. P. O. C. Aurivillius, of the Royal Museum in Stockholm, as a slight acknowledgment of the kindness with which he has frequently assisted me in the determination of African Lepidoptera.

9. ENOTESIA, sp.

Two much worn examples of the species allied to *E. ankoma* which Dr. Gregory obtained on Mount Kenya; unfortunately their condition is even less satisfactory than in the case of that specimen.

Kivata and Kazamaza's, Ruwenzori, 6000–8000 feet.

10. NEOCŒNYRA GREGORII?

Neocœnyra gregorii, Butler, P. Z. S. 1894, p. 560, pl. xxxvi. fig. 2.

Ruwenzori, 5600 feet; Kivata, 6000–8000 feet.

In these examples the submarginal lines on the under surface are ill-defined and not edged with red; the lines crossing the wings are very indistinct, almost obliterated; but the ocelli are so exactly those of *N. gregorii* that, without perfectly fresh examples, it would be rash to consider these as more than variations.

11. YPTHIMA ITONIA.

Ypthima itonia, Hewitson, Trans. Ent. Soc. ser. iii. vol. ii. p. 287, pl. 18. fig. 13 (1865).

Kampala and Uganda, Feb. 1894.

12. YPTHIMA ALBIDA.

Ypthima albida, Butler, P. Z. S. 1888, p. 59.

Kazamaza's, 5300 feet, 13th to 23rd April; Kivata, Ruwenzori, 6000–8000 feet; Uganda.

13. CHARAXES CANDIOPE.

Nymphalis candiope, Godart, Enc. Méth. ix. p. 352 (1823).

♂, Salt Lake to Wawamba country.

14. HYPOLIMNAS MISIPPUS.

Papilio misippus, Linnæus, Mus. Lud. Ulr. p. 264 (1764).

♂, Salt Lake to Wawamba country.

A single, much shattered example.

15. EURALIA ANTHEDON.

Diadema anthedon, Doubleday, Ann. & Mag. Nat. Hist. xvi. p. 181 (1845); Gen. Diurn. Lep. pl. 37. fig. 2 (1854).

♂, Salt Lake to Wawamba country.

16. EURALIA DUBIUS.

Papilio dubius, Beauv. Ins. Afr. Am. p. 238, pl. 6. figs. 2 *a*, *b* (1805).

♂, Salt Lake to Wawamba country.

A much rubbed example.

17. JUNONIA CALESCENS.

Junonia calescens, Butler, P. Z. S. 1893, p. 652.

Precis octavia, Staudinger, Exot. Schmett. pl. 38. fig. 4; *P. octavia*, var. *natalensis* (not *Precis natalica*, Feld.), *l. c.* p. 101.

Salt Lake to Wawamba country, also one much shattered example from Ruwenzori.

To avoid the confusion likely to arise from the adoption of Staudinger's varietal name, I have retained that applied to this species by myself.

18. JUNONIA GALAMI.

Vanessa galami, Boisduval, Faune Ent. Madag. p. 46 (1833).

Salt Lake to Wawamba country.

19. JUNONIA KOWARA.

Junonia kowara, Ward, Ent. Month. Mag. viii. p. 82 (1871); Afr. Lep. p. 6, pl. 5. figs. 5, 6, (1873).

♀. Ruwenzori, 6000–8000 feet.

One, unfortunately somewhat broken, example; the female is paler than the male; indeed, in the colouring of the discal belt it nearly resembles the male of the allied *J. aurorina*, only there is no lilacine suffusion on this belt, which is also broader and less angulated internally on the primaries; as in the male, it has no red markings across the discoidal cell.

20. JUNONIA PYRIFORMIS, sp. n. (Plate XLII. figs. 5, 6.)

♂. Allied to *J. kowara* and *J. sinuata*; primaries somewhat intermediate in form between the two, but the apical projecting portion narrower than in either; the secondaries much more elongated, with longer anal tail; no subangulation at extremity of radial nervure: in colouring it nearly resembles the most narrow-banded varieties of *J. sinuata*; but the tawny belt is brilliantly glossed, excepting at its margins, with soft rosy lilac; the under surface has the pattern of *J. aurorina*, but is darker throughout, with a purplish gloss. Expanse of wings 53–62 millim.

♀. Primaries with less arched costa, but more prominent subapical falcation; secondaries slightly broader and shorter; the belt very slightly paler than in the male. Expanse of wings 55 millim.

Ruwenzori, 5300, 5600, and 6000–8000 feet.

It is just possible that this may prove to be the early seasonal form of *J. sinuata*, but the difference in the outline of the wings is so considerable that, for the present, it is absolutely necessary to regard it as distinct. It is much more likely that *J. sinuata* will prove to be the late seasonal form of *J. kowara*.

21. JUNONIA INFRACTA.

Junonia infracta, Butler, P. Z. S. 1888, p. 63.

♂, Salt Lake to Wawamba country; ♀, Ruwenzori, 5300 feet.

The female is only slightly paler than the male, not of the black-and-white character of the typical example; the later consignment, however, included worn white specimens from Mumia and Malamba, and the more tawny form from Malamba and Uganda.

22. JUNONIA CEBRENE.

Junonia cebrene, Trimen, Trans. Ent. Soc. London, 1870, p. 353.

♀ ♀, Salt Lake to Wawamba Co., Berkeley Bay, Victoria Nyanza, and Uganda. Worn examples.

23. JUNONIA CLELIA.

Papilio clelia, Cramer, Pap. Exot. i. pl. xxi. E, F. (1779).

Uganda.

Only one much injured specimen was obtained.

In my paper on Dr. Gregory's collection I record (P. Z. S. 1894, p. 562) "*Junonia ethyra* (or a nearly allied species)." The present collection again contains a worn example of the same form, which I am now satisfied is distinct; I therefore describe it as new:—

24. JUNONIA GREGORII, sp. n. (Plate XLII. figs. 7, 8.)

Nearly resembling *J. ethyra* in pattern and colouring, excepting that the external area of the primaries is much blacker, and that the ocelli on all the wings are much nearer to the outer margin; the under surface is more olivaceous, yellower, with scarcely a trace of the lilac scaling of *J. ethyra*; the transverse dark line of the secondaries commences with a bifid tapering yellow spot, as in some examples of that species; the form of the wings is very different, the sinus of the outer margin being longer and more shallow; the small sinuations between the nervures are almost wholly absent, in both primaries and secondaries, and the latter wings are angulated, but not caudate, at extremity of radial vein; whilst the anal lobe is elongated. Expanse of wings 51 millim.

♂, Aln'garia (*Gregory*); ♀, Ruwenzori, 6000–8000 feet (*Scott Elliot*).

25. HYPANARTIA SCHŒNEIA.

Eurema schœneia, Trimen, Trans. Ent. Soc. London, 1879, p. 329; South Afr. Butt. i. p. 207, pl. iv. fig. 1 (1887).

Hypanartia commixta, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. v. p. 336 (1880).

Ruwenzori, 9000 feet.

As my short comparative description was based upon two examples from Natal (there being no specimens from Madagascar in our collection), the name *H. commixta* will fall to *H. schœneia*, not to *H. borbonica*, as Mr. Trimen judged—unless the species of Madagascar should prove (as I supposed) to be identical with that of South Africa; in which case, of course, it would take precedence of Mr. Trimen's name. It is even not impossible that *H. schœneia* may prove to be a seasonal form of *H. hippomene*; the range of the two is probably identical.

26. HYPANARTIA HIPPOMENE.

Hypanartia hippomene, Hübner, Samml. exot. Schmett. ii. pl. 25. figs. 3, 4 (1806).

Ruwenzori, 6000–9000 feet; Salt Lake to Wawamba.

We have this species from Madagascar; it differs somewhat from our other examples, the tawny band being slightly notched along its outer edge (as in Boisduval's figure of the long-tailed form, to which the name of *H. borbonica* has been given); on the underside also the angular postmedian band of the secondaries is more sharply edged and veined with pale yellow; such modifications may indicate a slight local influence, and, supposing *H. schœneia* to be a mere seasonal form of *H. hippomene*, would represent just such characters as one would expect to find in the corresponding seasonal form from Madagascar.

27. PYRAMEIS ABYSSINICA.

Pyrameis abyssinica, Felder, Reise der 'Novara,' Lep. iii. p. 397 (1867).

♂, ♀, Ruwenzori, 5600–8000 feet.

The examples obtained by Mr. Scott Elliot differ from that taken by Dr. Gregory in the much greater width of the tawny band across the primaries, which gives them a remarkable resemblance to *Hypanartia hippomene*; the tawny subapical costal patch, reddish cupreous basal suffusion, and absence of tail to the secondaries, however, at once distinguish them.

28. PYRAMEIS CARDUI.

Papilio cardui, Linnæus, Faun. Suec. p. 276 (1761).
Salt Lake to Wawamba.

29. EURYPHENE COCALIA.

Papilio cocalia, Fabricius, Ent. Syst. iii. 1, p. 250 (1793).
♂, Uganda.

30. HAMANUMIDA DÆDALUS.

Papilio dædalus, Fabricius, Syst. Ent. p. 482 (1775).
Malamba, Nyanza, 7000 feet, January 13th.
Both forms, supposed to be seasonal, were obtained.

31. ATERICA CUPAVIA.

Papilio cupavia, Cramer, Pap. Exot. ii. pl. cxciii. figs. E, F (1780).
♂, Salt Lake to Wawamba.

32. DIESTOGYNA RIBENSIS.

Aterica ribensis, Ward, Ent. Month. Mag. viii. p. 35 (1871) Afr. Lep. p. 12, pl. 9. figs. 7, 8 (1874).
♂, Kampala and Uganda, Feb. 1894.
Only one much worn specimen was obtained.

33. PSEUDARGYNNIS DUODECIMPUNCTATA.

Iaera duodecimpunctata, Snellen, Tijd. voor. Ent. 2nd ser. part 7, pl. 1. figs. 1, 2 (1872).
♀, Kazamaza's, Ruwenzori, 5300 feet, between 13th and 23rd April.

34. CATUNA CRITHEA.

Papilio crithea, Drury, Ill. Ex. Ent. ii. pl. xvi. figs. 5, 6 (1773).
Kampala and Uganda, Feb. 1894.

35. NEPTIS NEMETES.

Neptis nemetes, Hewitson, Ex. Butt. iv., *Nept.* pl. 1. figs. 1, 2 (1868).
Kampala and Uganda, Feb. 1894.

36. NEPTIS AGATHA.

Papilio agatha, Cramer, Pap. Exot. iv. pl. cccxxvii. figs. A, B (1782).
Ruwenzori, 5600 feet; Kampala and Uganda, Feb. 1894.
Salt Lake to Wawamba; Mumia, 4400 feet, Jan. 1894; Uganda.

37. NEPTIS MELICERTA.

Papilio melicerta, Drury, Ill. Ex. Ent. ii. pl. 19. figs. 3, 4 (1773).
Kampala and Uganda.

38. ERGOLIS ENOTREA.

Papilio enotrea, Cramer, Pap. Exot. iii. pl. ccxxxvi. figs. A, B (1782).

♂ ♀, Kivata, Ruwenzori, in May, 6000–8000 feet; ♀, Ruwenzori, 5600 feet; also a much broken example between Salt Lake and Wawamba and another from Uganda.

39. EURYTELA DRYOPE.

Papilio dryope, Cramer, Pap. Exot. i. pl. lxxviii. figs. E, F (1779).

Kivata, 6000–8000 feet, and Salt Lake to Wawamba.

40. BYBLIA ACHELOIA, var. CASTANEA.

Hypanis castanea, Butler, P. Z. S. 1885, p. 759.

♂ ♂, Victoria Nyanza, Jan. 3rd; Malamba, 7000 feet, Jan. 13th.

I agree with Prof. Aurivillius that the characters which distinguish this form from typical *B. acheloia* are seen to be variable when sufficient specimens are obtained, and therefore its distinctness as a species cannot be maintained; the extreme development of this form seems to be reached in Somali-land.

41. CYRESTIS CAMILLUS.

Papilio camillus, Fabricius, Sp. Ins. ii. p. 11 (1781).

Kampala and Uganda.

An extremely variable species, sometimes very heavily banded, but often almost as lightly as in the closely allied Madagascar form *C. elegans*; indeed, I fully expect to see these two supposed species completely linked by transitional varieties, just as, in the New-World genus *Helicopis*, the palest and darkest types of *H. cupido* grade one into the other.

42. ARGYNNIS EXCELSIOR, sp. n. (Plate XLII. fig. 4.)

♂. Nearly allied to *A. hanningtonii*[1] (Pl. XLII. fig. 3), from which it differs as follows:—Outer margin of primaries convex; colouring above deep tawny; outer border slightly narrower, with its inner edge undulated and separated from the submarginal series of black spots, which are also smaller: under surface with the primaries orange-tawny, excepting the apical area, which is dull creamy yellowish clouded with green; ground-colour of secondaries dull creamy yellowish, clouded with green; silver markings rather larger and more prominent than in *A. hanningtonii*; otherwise precisely similar, the disposition and character of the markings being the same. Expanse of wings 40–42 millim.

Female slightly duller and paler, with the borders less black and the marginal pale spots consequently longer than in the males. Expanse of wings 39 millim.

Ruwenzori, 5600 to 9000 feet.

Twelve more or less worn examples were obtained: Mr. Scott Elliot has a note that it "fertilizes the violet (*Viola abyssinica*)." There can be no doubt that this mountain form and that of

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[1] Elwes, Trans. Ent. Soc. Lond. 1889, p. 558.

Kilimanjaro had a common origin, but they are now too widely separated geographically to be regarded as one species, seeing that the differences of form and colouring between them are unquestionably constant.

43. ACRÆA SOTIKENSIS.

Acræa sotikensis, E. M. Sharpe, P. Z. S. 1891, p. 634, pl. xlviii. fig. 1.

Kazamaza's, Ruwenzori, 5300 feet, also 5600 feet.

44. ACRÆA PLANESIUM.

Acræa planesium, Oberthür, Études d'Entom. 17th livr. p. 24, pl. 1. fig. 11 (1893).

Kazamaza's, 5300 feet, between Kivata and Wimi camps, 7000–8000 feet, and Salt Lake to Wawamba.

45. ACRÆA ACERATA.

Acræa acerata, Hewitson, Ann. & Mag. Nat. Hist. ser. 4, vol. xiii. p. 381 (1874); Ex. Butt. v. *Acræa*, pl. 7. fig. 44 (1875).

Acræa vinidia, Hewitson, Ent. Month. Mag. xi. p. 130 (1874); Ex. Butt. l. c. figs. 45, 46.

Uganda.

A. vinidia is the commoner form of the species, *A. acerata* being based upon a female specimen in which the subapical patch of the primaries is united to the large tawny area; every gradation from one type to the other occurs in a long series: on the under surface there is practically no difference, the number of spots varies, but their position is constant.

46. ACRÆA EPONINA.

Papilio eponina, Cramer, Pap. Exot. iii. pl. cclxviii. figs. A, B (1782).

Kampala and Uganda. Worn examples labelled Victoria Nyanza and Mumia were also obtained.

47. ACRÆA LYCIA.

Papilio lycia, Fabricius, Syst. Ent. p. 464 (1775).

Var. *Acræa sganzini*, Boisduval, Faune Ent. Madag. p. 34, pl. 6. figs. 6, 7 (1833).

a. Kampala and Uganda (like *A. sganzini*, excepting that two-thirds of the hind wings are white).

b, *c*. Kazamaza's, 5300 feet, and between Kivata and Wimi, 7000–8000 feet (typical *A. sganzini*).

d. Salt Lake to Wawamba Co. (var. described P. Z. S. 1888, p. 66=*A. daira*, Godm.).

My observation respecting *A. cæcilia* (P. Z. S. 1894, p. 566) was a *lapsus* due to the crowded state of our collection of these butterflies (owing to constant accessions); it really applies to *A. sganzini*, not to *A. cæcilia*, which is a distinct species. In the later series specimens of typical *A. sganzini* and of my variety are recorded as taken at Ngurugani and Uganda, and the latter and *A. lycia* (typical) from Athi plains, 5000–6000 feet.

48. ACRÆA ITURINA?

Acræa iturina, Grose Smith, P. Z. S. 1890, p. 465.

♂, Ruwenzori, 6000–8000 feet; "Kivata," in May.

I rather doubt the distinctness of our examples from *A. orestia*; but possibly the type of *A. iturina* may be quite another species, though nearly allied.

49. ACRÆA QUIRINA.

Papilio quirina, Fabricius, Spec. Ins. ii. p. 36 (1781).

Kampala and Uganda, Feb. 1894.

50. ACRÆA PSEUDEGINA, aberr.

Acræa pseudegina, Westwood, Gen. Diurn. Lep. p. 531 (1852).

Salt Lake to Wawamba.

A single somewhat worn male; it differs from the typical form above in the total absence of the pale subapical spots of the primaries and of the dusky border and several of the central spots of the secondaries; on the under surface there is a trace of the first loop of the submarginal black line at anal angle; the spot above the upper discocellular vein is wanting, and one or two of the spots on the inner area are very slightly displaced, but not more than is often the case in varieties of a species.

51. ACRÆA PHARSALUS.

Acræa pharsalus, Ward, Ent. Monthl. Mag. viii. p. 81 (1871); Afr. Lep. i. p. 8, pl. vi. figs. 7, 8 (1873).

♂♂, Uganda.

These specimens agree perfectly with West African examples.

52. ACRÆA ZETES.

Papilio zetes, Linnæus, Syst. Nat. i. 2, p. 766 (1767).

Kampala and Uganda, Feb. 1894.

53. ACRÆA EGINA.

Papilio egina, Cramer, Pap. Exot. i. pl. xxxix. figs. F, G (1776).

Kampala and Uganda, Feb. 1894.

54. ACRÆA LYCOA.

Acræa lycoa, Godart, Enc. Méth. ix. p. 239 (1819).

♂, Kazamaza's, Ruwenzori, 5300 feet, between the 13th and 23rd April; ♀, Kivata, Ruwenzori, 6000–8000 feet, in May.

♀ *var.*? Somewhat resembling *Planema latifasciata*, E. M. Sharpe, the centre of primaries broadly ferruginous, the subapical spots united and ochreous, the patch at base of first median interspace almost obliterated, showing only above the spot at external angle as a diffused ochreous nebula, the spot referred to also ochreous; belt across secondaries ochreous.

♀, Kampala and Uganda, Feb. 1894.

Although Mr. Rothschild tells me he believes this may belong to a distinct species, I feel tolerably sure that it will prove to be only a form of *Planema lycoa*; the allied *P. johnstoni* varies in much the same way; the chief apparent difference really consists in the union of the subapical spots into an oblique band, but one of our female examples shows this character in the white spots. I am fully prepared to find, when these African *Acræinæ* are better understood, that the example set by Mr. Trimen in associating *P. esebria* and *P. protea* as varieties will have to be followed throughout this section of the genus.

55. POLYOMMATUS BÆTICUS.

Papilio bœticus, Linnæus, Syst. Nat. i. 2, p. 789 (1767).

A mere fragment from Ruwenzori, 5600 feet.

56. CATOCHRYSOPS PARSIMON.

Papilio parsimon, Fabricius, Syst. Ent. p. 526 (1775).

♂, Salt Lake to Wawamba.

We have two females of this species from the typical locality—Sierra Leone—in the British Museum collection. Speaking of the distinction between his *Lycæna patricia* and *L. parsimon*, my good friend Trimen says:—"the only constant distinction being in the subbasal row of spots on the underside of the hind wing, which in *patricia* has one spot less than in *parsimon*, as the third (between median and submedian nervures) is wanting." Now, Mr. Trimen mentions one of our females from Sierra Leone as belonging to *C. parsimon* and yet it and our second specimen from that locality have only three spots in the subbasal row on the underside of the hind wings. The male now received agrees perfectly with the male described by Mr. Trimen on the upper surface, but again has only three spots in the subbasal row on the under surface[1]. I have not the least doubt myself, though it requires to be proved by breeding, that *C. patricia* is a seasonal form of *C. parsimon* and that the number of spots in the subbasal row on the underside varies.

57. EVERES JOBATES.

Lycæna jobates, Hopffer, Peters' Reise n. Mossamb. pl. xxvi. figs. 9, 10 (1862).

Kampala and Uganda, Feb. 1894.

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[1] There is, however, one peculiarity about this example which is significant: on the left-hand side of the under surface the third spot is missing, as in *C. patricia*; but on the right-hand wing the first spot is absent and the third is present; we also have an example from Natal in which the third spot is almost gone.

58. LYCÆNESTHES AMARAH.

Polyommatus amarah, Lefebvre, Voy. Abyss. vi. p. 384, pl. xi. figs. 5, 6 (1847).

Berkeley Bay, Victoria Nyanza, Jan. 12th.

Only one much worn example was obtained.

59. TARUCUS PULCHER.

Lycæna pulchra, Murray, Trans. Ent. Soc. 1874, p. 524, pl. 10. figs. 7, 8.

Kampala and Uganda, Feb. 1894.

60. CASTALIUS MARGARITACEUS.

Castalius margaritaceus, E. M. Sharpe, P. Z. S. 1891, p. 636, pl. xlviii. fig. 3.

Ruwenzori, 5600–6000 feet, and Salt Lake to Wawamba.

61. ZIZERA KNYSNA.

Lycæna knysna, Trimen, Trans. Ent. Soc. London, 3rd ser. vol. i. p. 282 (1862).

Kazamaza's, Ruwenzori, 5300 feet, in April.

62. ZIZERA GAIKA.

Lycæna gaika, Trimen, Trans. Ent. Soc. London, 3rd ser. vol. i. p. 403 (1862).

Kampala and Uganda.

Three very much broken and worn examples.

63. ALLOTINUS ZYMNA.

Pentila zymna, Westwood, Gen. Diurn. Lep. pl. 76. fig. 7 (1852).

Kampala and Uganda.

64. HYREUS LINGEUS.

Papilio lingeus, Cramer, Pap. Exot. iv. pl. ccclxxix. figs. F, G (1782).

Salt Lake to Wawamba; Kampala and Uganda.

65. HYREUS FALKENSTEINII.

Plebeius falkensteinii, Dewitz, Nova Acta Leop.-Carol. Akad. Naturf. xli., ii. nr. 2, p. 204, pl. xxv. fig. 5 (1879).

Ruwenzori, 5600 feet; Kampala and Uganda, Feb. 1894.

The two examples obtained differ much in size and depth of colour, as well as in the width of the markings below, but are evidently only modifications of the same species.

66. HYREUS PALEMON.

Papilio palemon, Cramer, Pap. Exot. iv. pl. cccxc. figs. E, F (1782).

Kazamaza's, Ruwenzori, 5300 feet, 13th to 23rd April.

67. HYREUS ? ÆQUATORIALIS.

Lycæna æquatorialis, E. M. Sharpe, P. Z. S. 1891, p. 637, pl. xlviii. fig. 5.

Ruwenzori, 6000–9000 feet.

The specimens of this species were so much damaged as to be only just recognizable.

68. MYLOTHRIS CROCEUS, sp. n. (Plate XLIII. fig. 1.)

♂. Saffron-yellow; costal edge of primaries and a series of seven decreasing marginal spots from second subcostal branch to first median branch, also a scarcely perceptible dot at extremity of submedian vein, black; secondaries with seven black spots at the extremities of the veins; abdominal fold pale yellow, whitish at base; body black, clothed with greenish-grey hairs: wings paler on under surface, the secondaries and apex of primaries somewhat creamy; black marginal spots smaller than above; body below white; tibiæ and tarsi partly black. Expanse of wings 60–64 millim.

Salt Lake to Wawamba and Ruwenzori, 5000–8000 feet.

I know of no species nearly allied to this.

69. NYCHITONA SYLVICOLA.

Leucophasia sylvicola, Boisduval, Faune Ent. Madag. p. 20 (1833).

Ruwenzori, 5300–8000 feet; Salt Lake to Wawamba; Kampala and Uganda.

The series of this species, although somewhat worn, is interesting as forming a perfect transition from *N. sylvicola* to *N. nupta*; the latter is thus proved to be a mere sport of the former.

70. TERIAS ZOE.

Terias zoe, Hopffer, Ber. Verh. Ak. Berl. 1855, p. 460; Peters' Reise n. Mossamb., Zool. pl. 23. figs. 10, 11 (1862).

♀, Kivata, Ruwenzori, 6000–8000 feet, in May.

Only one much rubbed and broken example was taken; in the consignment subsequently received both sexes (also in bad condition) were present from Berkeley Bay, and a male from Uganda.

71. TERIAS REGULARIS.

Terias regularis, Butler, Ann. & Mag. Nat. Hist. ser. 4, vol. xviii. p. 486 (1876).

♂. Between Kivata and Wimi, Ruwenzori, 7000–8000 feet, May or June.

72. TERIAS DESJARDINSII.

Xanthidia desjardinsii, Boisduval, Faune Ent. Madag. p. 22, pl. 2. fig. 6 (1833).

♂ ♀, Kivata, Ruwenzori, 6000–8000 feet, May.

Corresponds with the most narrowly bordered of the varieties found in Natal. Typical females were subsequently received, obtained at Uganda.

73. TERIAS SENEGALENSIS.

Eurema senegalensis, Hübner, Zutr. exot. Schmett. figs. 969, 970 (1837).

♀, Kampala and Uganda, Feb. 1894.

74. TERIAS BRENDA.

Terias brenda, Doubleday, Gen, Diurn. Lep. pl. 9. fig. 6. (1847).

♂, Uganda.

75. CATOPSILIA PYRENE.

Colias pyrene, Swainson, Zool. Ill. i. pl. 51 (1820).

♂ ♀, Mumia; ♀, Uganda.

The specimens were much rubbed and broken.

76. TERACOLUS AURIGINEUS.

Teracolus aurigineus, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xii. p. 103 (1883).

♂ ♂, Victoria Nyanza, Jan. 12th.

Two much injured examples were obtained.

77. TERACOLUS MILES.

Teracolus miles, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xii. p. 105 (1883).

♂, Victoria Nyanza, Jan. 12th.

78. TERACOLUS HILDEBRANDTII.

♂. *Callosune hildebrandtii*, Staudinger, Exot. Schmett. p. 44, pl. 23 (1884–8).

♀ ? white, otherwise similar above to that sex of *T. phœnius* (P. Z. S. 1888, p. 74); below with all the discal spots and veins black, the spots on the secondaries forming a continuous band. Expanse of wings 44 millim.

♀, Kampala and Uganda, Feb. 1894.

The male of this species is, at present, not in the Museum series; but I saw several, some time since, in a collection of Lepidoptera from Uganda, purchased by Mr. Rothschild; the males at first sight appeared to represent two species, large and small, the larger form being typical *T. hildebrandtii*, and the smaller, to which the female before me would belong, being probably a seasonal form of the same.

79. TERACOLUS KEISKAMMA.

Anthocharis keiskamma, Trimen, Rhop. Afr. Austr. p. 56, pl. ii. figs. 3, 4 (1862–6).

♀, Victoria Nyanza, Jan. 12th.

A single quite typical, but somewhat rubbed and broken, example was obtained.

80. TERACOLUS LUCULLUS.

Teracolus lucullus, Butler, P. Z. S. 1876, p. 143, pl. 6. fig. 4.

♂, Kampala and Uganda, Feb. 1894; ♂, ♀ ♀, Victoria Nyanza, Jan. 12th.

81. TERACOLUS BIFASCIATUS.

Teracolus bifasciatus, E. M. Sharpe, Ann. & Mag. Nat. Hist. 6th ser. vol. v. p. 336 (1890).

♂, Salt Lake to Wawamba.

One much shattered example, and a second in better condition, from Victoria Nyanza, taken on the 12th January.

82. BELENOIS MESENTINA, var. AURIGINEA.

Belenois auriginea, Butler, P. Z. S. 1886, p. 375.

♀, between Kivata and Wimi, Ruwenzori, 7000–8000 feet, June.

This is the first African example of this form which I have seen; I very much doubt its being seasonal; it is always much rarer than the typical form and occurs with it. One male of var. *agrippina* was obtained at Berkeley Bay.

83. BELENOIS SEVERINA, var. INFIDA.

Belenois infida, Butler, P. Z. S. 1888, p. 78; 1894, pl. xxxvii. figs. 1, 2.

♂ ♂, ♀, between Kivata and Wimi, Ruwenzori, 7000–8000 feet, May and June; ♀ ♀, Salt Lake to Wawamba.

84. BELENOIS INSTABILIS.

Belenois instabilis, Butler, P. Z. S. 1888, p. 76.

♂ ♂, ♀ ♀, Berkeley Bay, Victoria Nyanza, Jan. 12th; ♂, Kampala and Uganda, Feb. 1894.

85. NEPHERONIA THALASSINA.

Pieris thalassina, Boisduval, Sp. Gén. Lép. i. p. 443 (1836).

♂, Kampala and Uganda, Feb. 1894.

86. SYNCHLOE JOHNSTONI.

Synchloe johnstoni, Crowley, Trans. Ent. Soc. 1887, p. 35, pl. iii. figs. 1–3.

♂ ♀, Uganda.

87. ERONIA DILATATA.

Eronia dilatata, Butler, P. Z. S. 1888, p. 96.

♂, Berkeley Bay, Victoria Nyanza, Jan. 12th.

One much shattered example was obtained.

88. PAPILIO DEMOLEUS.

Papilio demoleus, Linnæus, Mus. Lud. Ulr. p. 214 (1764).

Kampala and Uganda, Feb. 1894.

One shattered example only was obtained.

89. PAPILIO MACKINNONI.

Papilio mackinnoni, E. M. Sharpe, P. Z. S. 1891, p. 187, pl. xvi. fig. 1.

Between Kivata and Wimi, Ruwenzori, 7000–8000 feet, May or June.

90. PAPILIO BROMIUS.

Papilio bromius, Doubleday, Ann. & Mag. Nat. Hist. xvi. p. 176 (1845).

Var. *Papilio brontes*, Godman, P. Z. S. 1885, p. 540.

Salt Lake to Wawamba.

The single example received is in fairly good condition and is especially interesting. On the upper surface it agrees with *P. bromius* excepting in its bluer bands; on the under surface, however, it agrees in almost every respect with the type of *P. brontes*; this being the case, it is no longer possible to consider the latter a distinct species.

91. PAPILIO ERINUS.

Papilio erinus, Gray, Cat. Lep. Ins. B. M. i. p. 35 (1865).

♀, Salt Lake to Wawamba.

One damaged specimen was obtained.

92. PAPILIO JACKSONI.

Papilio jacksoni, E. M. Sharpe, P. Z. S. 1891, p. 188, pl. xvii. figs. 1, 2.

♂. Salt Lake to Wawamba; ♀, Ruwenzori, 9000 feet.

P. preussius, Karsch, appears to me to be based solely upon the wider white band across the primaries of the male, and is likely to prove a mere variety; the female of *P. echerioides* (see Oberthür, Études, xiii. pl. 2. fig. 6, 1890) nearly resembles the female of *P. jacksoni*, but differs somewhat in the position of the submarginal spots.

93. SARANGESA DJÆLÆLÆ.

Pterygospidea djælælæ, Wallengren, Kongl. Svensk. Vet.-Acad. Handl. 1857; Lep. Rhop. Caffr. p. 54.

Salt Lake to Wawamba.

94. PYRGUS DROMUS.

Pyrgus dromus, Plötz, Mitth. naturw. Vereine Neu-Vorpomm. und Rügen 1884, p. 6.

Kivata, Ruwenzori, 6000–8000 feet, May.

A fragment, apparently referable to this species.

95. CYCLOPIDES MIDAS.

Cyclopides midas, Butler, P. Z. S. 1893, p. 671; 1895, pl. xv. fig. 6.

Kazamaza's, 5300 feet; Kivata, 6000–8000 feet, Ruwenzori; April and May.

Two somewhat aberrant examples wanting the subbasal orange spots; possibly representing a distinct local race.

96. HETEROPTERUS LEPELETIERII.

Hesperia lepeletier, Latreille, Enc. Méth. ix. p. 777 (1823).

Kampala and Uganda, Feb. 1894.

97. PADRAONA ZENO.

Pamphila zeno, Trimen, Trans. Ent. Soc. London, 3rd ser. ii. p. 179 (1864); South Afr. Butt. iii. pl. xii. fig. 2, ♀.

♂, Ruwenzori, 5600 feet; ♀, Salt Lake to Wawamba.

More nearly related to *P. watsoni* than to any other species, but smaller and differing considerably in the definition of the markings and the ground-colour of the under surface.

98. RHOPALOCAMPTA UNICOLOR.

Ismene unicolor, Mabille, Ann. Soc. Ent. France, sér. 5, vol. vii. p. xxxix (1877).

Kazamaza's, 5300 feet, and Kivata, 6000–8000 feet, Ruwenzori, in April and May.

HETEROCERA.

99. MACROGLOSSA TROCHILUS.

Psithyros trochilus, Hübner, Samml. exot. Schmett. ii. pl. 158. figs. 1–4 (1806).

Salt Lake to Wawamba.

Only one much worn example was obtained.

100. XANTHOSPILOPTERYX DEFICIENS.

♀. *Eusemia deficiens*, Mabille, Bull. Soc. Ent. France, 1891; Novit. Lepid. vii. p. 53 (1892).

Eusemia pallida, Mabille (not Walker), Novit. Lepid. vii. pl viii. fig. 4 (1892).

♂. Precisely like *X. fatima*, Kirby, excepting that the subbasal trifid ochreous band of that species is here represented by three small isolated spots: the black outer border of the secondaries differs from that of the female as in *X. incongruens*.

♂, Kazamaza's, Ruwenzori, 5300 feet, between the 13th and 23rd April.

101. XANTHOSPILOPTERYX INCONGRUENS.

Eusemia incongruens, Butler, P. Z. S. 1878, p. 381.

♀♀, Salt Lake to Wawamba.

The specimens are not quite typical, but vary towards *X. thruppii*.

102. XANTHOSPILOPTERYX HYPERCOMPOIDES, sp. n. (Plate XLIII. fig. 5.)

Primaries above bronze-greenish black, with ochreous markings arranged somewhat as in *X. fatima*, but the lower spot of the two crossing the centre of the wing much smaller; the subapical band also quite different in form, narrow towards the costa and elongated below into a sort of cuneiform (foot-shaped) patch, the point of which rests on the outer margin: secondaries deep orange in the type (probably rosy crimson when fresh), with broad apical patch, but rather narrow marginal continuation to anal angle: body black; head, collar, and pterygodes spotted with pale ochreous; metathorax clothed at the sides with ochreous hairs; an ochreous anal tuft. Basal area of primaries below ochreous, with two large black spots placed obliquely before the middle; apical half black, with creamy brimstone-coloured markings as above, but broader, the subapical band greatly resembling the lower half of a human leg; secondaries nearly as above: body below black spotted with white. Expanse of wings 63 millim.

Kazamaza's, Ruwenzori, 5300 feet, 13th–23rd April.

103. CHARILINA AMABILIS.

Noctua amabilis, Drury, Ill. Exot. Ent. ii. pl. 13. fig. 3 (1773).

Kampala and Uganda.

104. SYNTOMIS FANTASIA.

Syntomis fantasia, Butler, Journ. Linn. Soc. Lond., Zool. xii. p. 349 (1876).

Salt Lake to Wawamba.

Rather smaller than the type, with which, however, the examples obtained agree tolerably closely in pattern.

Uganda.

105. EPITOXIS, sp.

Two much worn females of an apparently undescribed species; not in sufficiently good condition for description.

Ruwenzori, 7000–8000 feet.

106. CALLARCTIA ELLIOTI, sp. n. (Plate XLIII. fig. 6.)

Allied to *C. geometrica* from Abyssinia; but the longitudinal band of the primaries running obliquely from the costa, emitting two parallel bands from the back, one to base, the other to inner margin, the direction of the band at end of cell reversed, the band itself thickened and abbreviated; the two remaining bands forming a simple cross and not continued below the longitudinal band: secondaries rose-coloured; the submarginal spots forming a series of three patches, with a wide interval opposite the end of the cell; the abdomen rosy, with dorsal and lateral series of blackish spots. Expanse of wings 46 millim.

♀, Kampala and Uganda.

One fairly good example was obtained.

107. Pleretes tigris.

Hypercompa tigris, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xii. p. 106 (1883).

Ruwenzori, 6000 feet; Kampala and Uganda.

108. Canopus bubo.

Canopus bubo, Walker, Cat. Lep. Het. iii. p. 747 (1855).

Between Kivata and Wimi, Ruwenzori, 7000–8000 feet, May or June.

109. Alpenus æqualis.

Alpenus œqualis, Walker, Cat. Lep. Het. iii. p. 686 (1855).

Uganda.

One much worn specimen.

110. Argina amanda.

Euchelia amanda, Boisduval, Voy. de Deleg. ii. p. 597 (1847).

Salt Lake to Wawamba.

There is a fragment of a *Lepista* (perhaps *L. pandula*), too much injured for identification, from Salt Lake.

111. Eligma duplicata.

Eligma duplicata, Aurivillius, Ent. Tidskr. xiii. p. 190 (1892).

Kampala and Uganda.

112. Malacosoma? thoracica sp. n. (Plate XLIII. fig. 4.)

Allied to *M. rennei*, Dewitz; much smaller; costal margin and veins of primaries dusky; inner stripe of primaries transverse, very slightly arched, outer stripe oblique, incurved towards costa, both stripes grey, broader than in *M. rennei*; submarginal spots more regular, nearer to outer margin, well defined also on the secondaries; thorax and base of primaries bright ochreous, anal tuft creamy ochraceous above: wings below nearly as in *M. rennei*; body below ochreous with a central ventral series of grey transverse bars. Expanse of wings 65 millim.

Between Kivata and Wimi, Ruwenzori, 7000–8000 feet, May or June.

It is probable that this species and *M. rennei* will prove to belong to a genus distinct from *Malacosoma*. The genera of African *Bombyces* badly need revision, and it is satisfactory to know that Prof. Aurivillius hopes shortly to undertake this work, for which his long and careful study of African Lepidoptera pre-eminently fits him.

113. Nonagria? sp.

A much damaged example of a moth, probably allied, if not belonging, to *Nonagria*, but quite unrecognizable.

Kazamaza's, Ruwenzori, 5300 feet.

114. REMIGIA REPANDA.

Noctua repanda, Fabricius, Ent. Syst. iii. 2, p. 49 (1793).

Kampala and Uganda, Feb. 1894.

115. HYPENA VELATIPENNIS.

Hypena velatipennis, Butler, Ann. & Mag. Nat. Hist. ser. 4, vol. xvi. p. 410 (1875).

Kazamaza's, Ruwenzori, 5300 feet, between 13th and 23rd April.

The single example obtained was so much worn and broken as to be barely identifiable.

116. ZEBRONIA PODALIRIALIS.

Spilomela podalirialis, Guenée, Delt. et Pyr. p. 281.

Kampala and Uganda, Feb. 1894.

117. COPTOBASIS OVALIS.

Botys ovalis, Walker, Lep. Het. xviii. p. 636.

Kazamaza's, Ruwenzori, 5300 feet, between 13th and 23rd April.

One much shattered and worn example, apparently referable to this species.

118. ACROPTERIS ERYCINARIA.

Micronia erycinaria, Guenée, Uran. et Phal. ii. p. 30 (1857).

Kampala and Uganda, Feb. 1894.

One shattered example.

119. HETERABRAXAS ROSEOVITTATA, sp. n. (Plate XLIII. figs. 2, 3.)

♀. Primaries creamy whitish, with pale golden reflections; coarsely and sparsely striated with short black lines and traversed longitudinally by two divergent rose-coloured streaks, the first passing through the cell and the second through interno-median interspace; faint traces of rosy streaks also between the subcostal veins: secondaries silvery white flecked with black: head and prothorax ochreous; antennæ dull black; meso- and metathorax rose-colour; abdomen ochreous, barred with grey and speckled with black. Wings below sericeous white, with yellowish tinted costal borders: primaries suffused with pale pink and with fairly well-defined rose-coloured longitudinal streaks as above; transverse striations mostly grey excepting on costal margin: secondaries more strongly flecked with black than above: pectus and femora rose-coloured, tibiæ and tarsi fuliginous; venter ochreous, mottled with black. Expanse of wings 48 millim.

♀, Kampala and Uganda, Feb. 1894.

This very aberrant-looking *Heterabraxas* differs from its Indian and European allies in its relatively smaller secondaries and the straighter costal margin of the primaries; the nervures, especially towards the costa, are also less curved, but do not appear to differ in disposition. The male has since been received.

120. STERRHANTHIA SACRARIA.

Phalæna-Geometra sacraria, Linnæus, Syst. Nat. i. 2, p. 863.
Uganda.

121. ACIPTILUS, sp.

Allied to *A. pentadactylus*, but too much injured for identification.
Ruwenzori, 6000–8000 feet.

EXPLANATION OF THE PLATES.

PLATE XLII.

Fig. 1. *Amauris ellioti*, p. 723.
2. *Mycalesis aurivillii*, p. 724.
3. *Argynnis hanningtonii*, p. 729.
4. —— *excelsior*, p. 729.
5, 6. *Junonia pyriformis*, p. 726.
7, 8. —— *gregorii*, p. 726.

PLATE XLIII.

Fig. 1. *Mylothris croceus*, p. 734.
2, 3. *Heterabraxas roseovittata*, ♂ ♀, p. 741.
4. *Malacosoma? thoraciea*, p. 740.
5. *Xanthospilopteryx hypercompoides*, p. 739.
6. *Callarctia ellioti*, p. 739.

5. Report on the Parasitic Hymenoptera of the Island of Grenada, comprising the Families *Cynipidæ, Ichneumonidæ, Braconidæ,* and *Proctotrypidæ.* By WILLIAM H. ASHMEAD.[1]

[Received October 18, 1895.]

Through the kindness of Dr. C. V. Riley, I have been enabled to furnish the report upon the specimens of parasitic Hymenoptera, comprising the families *Cynipidæ*, *Ichneumonidæ*, *Braconidæ*, and *Proctotrypidæ*, collected by Mr. Herbert H. Smith in the Island of Grenada. The collection was transmitted to Dr. Riley to be worked up, by Dr. David Sharp on behalf of the Committee for investigating the Flora and Fauna of the West-Indian Islands.

In the families *Ichneumonidæ* and *Braconidæ* comparatively few specimens were taken, and, although some few species were found to be new to science, the majority were already known, many of them having been described quite recently by the writer in his report upon the St. Vincent Hymenoptera.

The family *Ichneumonidæ* was represented by only nine species, but of this number five proved to be new. The others occur in St. Vincent and Cuba.

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[1] Communicated by Dr. D. SHARP, F.R.S., F.Z.S., on behalf of the Committee for investigating the Flora and Fauna of the West-Indian Islands.

In the family *Braconidæ* some twenty-nine species were taken, representing seven *new* and twenty-two described species. Of the twenty-two described species, twenty have already been reported from St. Vincent, while two, *Macrocentrus delicatus*, Cr., and *Hormius melleus*, Ashm., occur in Florida and other parts of the United States, and are now reported for the first time from the West Indies. *Macrocentrus delicatus*, Cr., is also found in Mexico.

The two other families mentioned—the *Cynipidæ* and the *Proctotrypidæ*—were exceedingly rich in species, the vast majority of them being microscopic in size and difficult to study.

In the family *Cynipidæ* no less than seventy species were recognized, all belonging to the parasitic subfamily *Eucoelinæ*. It is worthy of note that, up to the present time, not a single gall-making species in this family is yet reported from the West Indies,—the species reported and described by Cresson from Cuba, and supposed to be true gall-makers, being all parasitic forms.

Of the seventy species mentioned in this report, eight only were described, and these are from St. Vincent[1]. All the others are apparently new. These are distributed in eighteen genera, of which five are new.

The family *Proctotrypidæ* is represented by seventy-five species distributed in twenty-nine genera, only one genus being new. Of the species twenty-one have been described. Two species, *Aphelopus albopictus*, Ashm., and *Ceraphron basalis*, Ashm., occur in the United States, while all the others were quite recently described from St. Vincent.

The six new genera and one hundred and twenty-eight new species of parasitic Hymenoptera described in this report admirably illustrate the wonderful richness of the West-Indian fauna, and the amount of work yet to be done before sufficient data will have been accumulated to afford a basis for a safe generalization upon the distribution of these insects.

Family CYNIPIDÆ.

Subfamily EUCOELINÆ.

GRONOTOMA, Förster.

GRONOTOMA INSULARIS, sp. n.

♀. Length 1·1 mm. Robust, polished black; first four or five joints of antennæ red; legs reddish yellow, the middle and hind coxæ black. Wings hyaline, strongly iridescent, with short ciliæ; the venation yellowish, the marginal cell closed, about 1½ times as long as wide, the second abscissa of radius being about 1½ times as long as the second.

Head transverse, as wide as the widest part of the thorax, perfectly smooth, impunctate, the occiput not margined; palpi

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[1] See Journ. Linn. Soc., Zool. xxv. pp. 61–78.

yellowish; mandibles blackish. Antennæ 13-jointed, subclavate, submoniliform, as long as the body, the third joint the longest, about 1½ times as long as the fourth, subclavate, the following joints very slightly increasing in width but very gradually decreasing in length, the three or four terminal joints being almost moniliform and very little longer than thick, the last ovate, a little longer and stouter than the penultimate; the seven terminal joints are all longitudinally striated. Thorax about twice as long as wide and perfectly smooth; the parapsidal furrows start rather close together from the anterior margin of the mesonotum, gradually converge and form a narrow wedge-shaped elevation or carina on its surface; scutellum elevated, rugose, sparsely pubescent, the cup large, oval, its entire disk excavated and with a longitudinal grooved line at bottom, the margins piceous; metathorax roughened, with the pleura pubescent. Abdomen shorter and much narrower than the thorax, subcompressed, viewed from the side squarely truncate at apex, the apical segments being retracted.

Mount Gay Estate. Described from one female specimen.

DIGLYPHOSEMA, Förster.

DIGLYPHOSEMA FLAVIPES, Ashm. Journ. Linn. Soc., Zool. xxv. p. 61.

Mount Gay Estate. One female specimen.

DICERATASPIS, Ashm., gen. nov.

Resembles *Hexaplasta*, Förster, but is at once separated from it and allied genera by having no pubescent or striated girdle at base of abdomen, and by having the rugose scutellum bidentate behind; *i. e.* each hind angle is produced into a prominent tooth or prong. The cup is small, ovate, carinated anteriorly, with a fovea on the disk; the antennæ are 13-jointed and terminate in an abrupt 6-jointed club; the marginal cell being open along the fore margin; while the metanotum is smooth with a median carina.

Male unknown.

DICERATASPIS GRENADENSIS, sp. n.

♀. Length 1·1 mm. Polished black; two basal joints of antennæ and the legs, including coxæ, yellow, the rest of antennæ brownish piceous. Wings hyaline, the venation yellowish, the marginal cell open along the fore margin, the second abscissa of radius almost twice as long as the first. The first joint of the funicle is about twice as long as thick, the others a little shorter, subequal, the last being hardly longer than thick; club-joints, except the last, submoniliform, about 1½ times as long as thick, the last ovate; all club-joints faintly striated.

Mount Gay Estate. Described from one female specimen.

I have also examples of another undescribed species belonging to this genus, collected by Mr. Herbert H. Smith in Brazil.

COTHONASPIS, Hartig.

COTHONASPIS ATRICORNIS, sp. n.

♀. Length 0·8 mm. Polished black; trochanters, knees, tips of tibiæ, and tarsi dark honey-yellow or reddish yellow.

Antennæ 13-jointed, black, hardly as long as the thorax, the last five joints forming an abrupt club; scape clavate, not quite 3 times as long as the pedicel; funicle 6-jointed, very slender, the first joint a little longer than thick at apex, the following joints moniliform; club 5-jointed, the joints slightly increasing in size; scutellum closely punctate, the cup small, oval, its disk with a median channel, appearing as if composed of two foveæ conjoined. Wings hyaline, ciliated, the tegulæ piceous black, the venation dark brown, the marginal cell completely closed; the first abscissa of radius a little shorter than the second, with an almost imperceptible inward curve, the second abscissa straight. Abdomen compressed, nearly as long as the head and thorax united, perfectly smooth and bare at base.

Balthazar. Described from one female specimen.

KLEIDOTOMA, Westwood.

Table of Species.

Females.

Wings entire .... 2.
Wings excised at tip, or cordate .... 3.

2. All coxæ, except sometimes the anterior pair, black; scape about 3 times as long as the pedicel; antennæ, except sometimes the funicle, black; legs dark red, the femora obfuscated or blackish.
    First joint of funicle three times longer than thick, the four following joints a little longer than thick, the last three rounded; cup with a small fovea and two punctures .... *K. atrocoxalis*, sp. n.
    First joint of funicle twice as long as thick, the following moniliform, subequal; cup with a single fovea but without punctures .... *K. insularis*, Ashm.
  Hind coxæ rufo-piceous, the anterior and middle coxæ reddish yellow; scape scarcely three times as long as the pedicel; antennæ, except the funicle and sometimes more or less of pedicel which are piceous or rufous, black.
    First joint of funicle about twice as long as thick, the second a little longer than thick, the following all small, moniliform; legs reddish yellow, the femora more or less obfuscated toward base; cup small, with a single fovea .... *K. smithii*, sp. n.
3. All coxæ and legs red, reddish yellow, or yellow.
  Marginal vein three or more times longer than thick; scape very little longer than the pedicel.
    Antennæ, except club, and the legs reddish yellow, club black.
      First joint of funicle 2½ times as long as thick, the following joints moniliform, the last two or three a little wider than long .... *K. marginalis*, sp. n.

Antennæ, except club, and legs yellow, rarely with a rufous tinge.
  First joint of funicle twice as long as thick, joints 2 to 5 truncate at apex, not moniliform, joints 6–8 moniliform, the last a little the widest... *K. nana*, sp. n.
Marginal vein not or very little longer than thick, scape twice as long as pedicel or only slightly longer; antennæ rufo-piceous, the scape and club blackish.
  First joint of funicle hardly 1½ times as long as thick, the following joints, except the second, moniliform, very slightly and gradually increasing in size; cup of scutellum very small, reduced to a mere carina .... *K. pygidialis*, sp. n.
  First joint of funicle a little more than twice as long as thick, joints 2–6 subequal, truncate at apex, narrowed toward base, joints 7–8 moniliform, the last a little the larger; cup of scutellum narrowed, elliptic, with 2 punctures. *K. bipunctata*, sp. n.

(1) KLEIDOTOMA ATROCOXALIS, sp. n.

♀. Length 1·5 mm. Polished black; antennæ (except funicle, which is more or less reddish or piceous) and legs (except trochanters, tips of femora, and tibiæ and tarsi, which are reddish yellow) black; mandibles large, red.

Head viewed from in front oval. Antennæ 13-jointed, extending to apex of metathorax; the scape long, clavate, 3½ times as long as the pedicel, the latter oval; funicle much slenderer than the pedicel, 8-jointed, the first joint three or more times longer than thick, joints 2–5 subequal, a little longer than thick, joints 6–8 rounded; club abrupt, 3-jointed, stout, the first joint about 1½ times as long as thick, the second twice as long as thick, the third ovate, 2½ times as long as thick. Thorax subovoid, about three times as long as wide, the collar anteriorly visible from above as a sharp transverse ridge, the mesonotum fully twice as long as wide at base; the scutellum striated along the sides, behind truncate and with the truncature margined, the cup very small, oval, connected with a carina at the bottom of the basal fovea, its disk with a small fovea behind and two small punctures on the anterior part; metathorax closely punctate, with a median carina. Wings hyaline, rounded at apex, the tegulæ piceous, the veins yellowish, the marginal vein (or third branch of the submarginal) hardly longer than thick, the marginal cell open along the fore margin and fully twice as long as wide, the first abscissa of radius a little longer than the second, the latter with a slight appendage extending along the costal margin. Abdomen nearly as long as the head and thorax united, viewed from the side obliquely truncate at apex, above with a slight rim at base but without pubescence, and, except some striæ at base, perfectly smooth and polished.

Mount Gay Estate. Described from a single specimen. The shape of the wings, colour of legs, and non-pubescent girdle at base of abdomen readily distinguish the species.

(2) KLEIDOTOMA INSULARIS, Ashm. Journ. Linn. Soc., Zool. xxv. p. 69.

Balthazar. A single specimen. In not having the front wings emarginate at apex, no pubescent girdle at base of abdomen, and in having black coxæ, this species approaches nearest to *K. atrocoxalis*, but it is slightly smaller, the antennæ are different, and the cup of scutellum is without punctures on the fore part.

(3) KLEIDOTOMA SMITHII, sp. n.

♀. Length 0·9 to 1·1 mm. Polished black; antennæ (except the funicle and sometimes more or less of pedicel, which are more or less piceous) black; legs (except the hind coxæ, which are rufo-piceous) reddish yellow; mandibles and palpi yellowish.

Antennæ 13-jointed, extending to apex of thorax, the scape hardly three times as long as the pedicel; funicle 8-jointed, the first joint about twice as long as thick, the second very little longer than thick, the following small, moniliform, the last a little the widest; club 3-jointed, the first and second joints about equal in size, 1½ times as long as thick, the last ovate, about twice as long as thick, all delicately fluted. Thorax subovoid, the mesonotum hardly twice as long as wide; scutellum striated at sides, behind punctate, the cup small, with a single fovea, but without punctures. Wings hyaline, ciliated, the apex rounded, entire; the veins yellowish, the marginal vein quadrate, the marginal cell a little more than twice as long as wide, open along the fore margin, the first abscissa of radius a little longer than the second. Abdomen a little longer than the thorax, with a raised non-pubescent ring at base.

♂. Length 0·75 mm. Polished black; antennæ 15-jointed, filiform, about 1½ times as long as the body, brownish yellow, more or less dusky toward tips, the flagellar joints all fluted, the scape not twice as long as the pedicel; the first joint of flagellum slightly curved, about twice as long as the second, which is the smallest joint, the joints after the second longer, subequal, about twice as long as thick. Wings as in female. Legs brownish yellow or reddish yellow.

Balthazar and Grand Étang. Described from 2 male and 4 female specimens.

(4) KLEIDOTOMA MARGINALIS, sp. n.

♀. Length 0·45 to 0·8 mm. Polished black; antennæ (except club and sometimes the two basal joints) and legs (including coxæ) reddish yellow; club black or piceous; mandibles red; palpi yellowish.

Antennæ 13-jointed, extending to base of abdomen, the scape only a little longer than the pedicel; funicle 8-jointed, the first joint about 2½ times as long as thick, the following joints moniliform, the last two or three a little wider than long; club 3-jointed, the first joint the smallest, about 1½ times as long as thick, the second about twice as long as thick, the third ovate, slightly longer.

Thorax subovoid, the mesonotum only about 1½ times as long as wide at base; cup of scutellum oval, connected with a carina at bottom of fovea, its disk posteriorly with a single fovea. Wings hyaline, cordate; the veins dark brown or piceous, the marginal vein fully thrice as long as thick or a little longer, the second abscissa of radius stouter and longer than the first, the marginal cell open along the fore border and scarcely 1½ times as long as wide. Abdomen about as long as the thorax or a little longer, with a distinct woolly girdle at base.

Balthazar. Described from 7 female specimens.

(5) KLEIDOTOMA NANA, sp. n.

♀. Length 0·6 to 0·8 mm. Polished black; antennæ, except club, and legs yellow, rarely with a reddish tinge; mandibles rufous. Antennæ 13-jointed, reaching to base of abdomen, the scape not or scarcely longer than the pedicel; funicle 8-jointed, the first joint only twice as long as thick, joints 2–5 not longer than thick, truncate at apex, not moniliform, joints 6–8 moniliform, the last widest; club 3-jointed, the first and second subequal, about 1½ times as long as thick, the last ovate, a little longer. Thorax, wings, and abdomen as in preceding species (*K. marginalis*).

♂. Length 0·65 mm. Agrees with female, except the antennæ are 15-jointed, filiform, brown or brownish yellow, more or less dusky toward apex, the first joint of the flagellum being not quite twice as long as the second, the second only slightly shorter than the third, the fourth and following are equal, about three times as long as thick, while the wings are entire at apex; otherwise in venation and colour of legs it agrees with the female.

Balthazar. Described from 9 female and 3 male specimens.

(6) KLEIDOTOMA PYGIDIALIS, sp. n.

♀. Length 0·75 mm. Polished black; antennæ, except club, rufo-piceous; legs reddish yellow, the coxæ paler or yellowish; mandibles red. Antennæ 13-jointed, not longer than the head and thorax united, the scape hardly twice as long as the pedicel, much narrowed at base; funicle 8-jointed, the first joint obconical, about 1½ times as long as thick, the second obconical, only a little longer than wide; the following joints moniliform, very slightly and gradually increasing in size; cup of scutellum very small, reduced to a mere carina. Wings hyaline; the veins yellowish, the marginal vein quadrate, the first abscissa of radius a little longer than the second, the marginal cell only a little longer than wide, open along the front margin. Abdomen a little longer than the head and thorax united, black, with a griseous woolly girdle at base and with a prominent, ploughshare-shaped brown ventral valve.

Balthazar. Described from one female specimen.

(7) KLEIDOTOMA BIPUNCTATA, sp. n.

♀. Length 1 to 1·1 mm. Polished black; antennæ piceous black, the funicle dark rufous; legs red or reddish yellow; mandibles red.

Antennæ 13-jointed, a little longer than the head and thorax united, the scape nearly twice as long as the rounded pedicel; funicle 8-jointed, the first joint a little more than twice as long as thick, joints 2–6 subequal, truncate at apex and a little narrowed toward base, joints 7–8 moniliform, the 8th a little the larger; club 3-jointed, the first and second equal, about twice as long as thick, the last ovate, a little longer. Thorax subovoid, the mesonotum about twice as long as wide at base, the scutellum finely striated at sides; the cup small, elliptical, with two equal-sized punctures on disk. Wings hyaline; veins testaceous, the marginal vein scarcely longer than thick, the second abscissa of radius thicker but not longer than the first. Abdomen about as long as the head and thorax united, with a dense griseous woolly girdle at base.

♂. Length 1 mm. Differs from female in having long, filiform, 15-jointed antennæ, the two basal joints reddish yellow, the flagellum blackish, with all the joints fluted. The first joint of flagellum is about one-third longer than the second, but a little shorter than the terminal joints, the second joint is the smallest, the joints beyond very gradually although imperceptibly increasing in size, the last four joints being a little longer than the first. Wings slightly excised at apex; scutellum as in female, with two punctures.

Balthazar. Described from one male and two female specimens.

PENTACRITA, Förster.

Table of Species.

All coxæ and femora brown, rest of legs honey-yellow .... 2.

All coxæ black.

Wings at apex entire; antennæ, except apex of pedicel, black; the scape clavate, a little more than three times as long as thick at apex, the first joint of funicle fully 3½ times as long as thick; cup of scutellum small, ovate, with its disk smooth, impunctate .... *P. coxalis.*

2. Wings with a slight sinus or emargination at apex; antennæ with the pedicel and funicle rufo-piceous, the scape clavate, the first joint of funicle three times as long as thick; cup of scutellum elliptic, with a small fovea posteriorly and a single puncture on the anterior part .... *P. proxima.*

(1) PENTACRITA COXALIS, sp. n.

♀. Length 1·2 mm. Polished black; antennæ, except apex of pedicel, black; legs honey-yellow, the coxæ black, the clavate portions of femora dark brown or blackish; mandibles reddish. Antennæ 13-jointed, a little longer than the head and thorax united; the scape clavate, 3½ times as long as thick at apex, the pedicel a little longer than thick; funicle 6-jointed, the first joint 3½ times as long as thick, the second only a little longer than thick, joints 3–6 moniliform, the last two a little smaller than the fourth joint; club 5-jointed, the first joint rounded, considerably smaller than the other joints, 2–4 subequal, a little longer than thick, the last ovate, a little longer than the preceding and slightly more than twice as long as thick; all club-joints fluted. Mesonotum fully twice as long as wide at base; collar striated at sides; scutellum indistinctly or feebly striated at sides; the cup small, ovate, with the disk smooth, impunctate. Wings hyaline, entire and rounded at apex, ciliated; the veins (except the basal nerve, stigma, and marginal vein, which are piceous) reddish yellow; the marginal vein is open along the fore margin, while the first and second abscissas of radius are about equal in length, the marginal cell being a little more than twice as long as wide. Abdomen not quite so long as the head and thorax united, with a slight rim at base but without pubescence, and, except some striæ at base above, perfectly smooth and polished.

Balthazar. Described from one female specimen.

(2) PENTACRITA PROXIMA, sp. n.

♀. Length 1 mm. Polished black; antennæ rufo-piceous, the club black; legs honey-yellow, the coxæ and clavate parts of femora brown or rufo-piceous; mandibles reddish yellow.

Antennæ 13-jointed, about as long as the head and thorax united; the scape clavate, 3 times as long as thick; funicle 6-jointed, the first joint 3 times as long as thick, the second hardly longer than thick, joints 3 to 6 moniliform, equal in size; club 5-jointed, the first rounded and much smaller than the second, the second smaller than the third but a little longer than thick, joints 3–4 subequal, oblong, the fifth ovate, hardly twice as long as thick. Mesonotum not twice as long as wide at base, the scutellum distinctly striated at sides; the cup small, elliptic, with a small fovea posteriorly and a single puncture on the anterior part. Wings hyaline, ciliate, the apex of front pair with a slight sinus; otherwise the venation is similar to *P. coxalis*, except that the second abscissa of radius is evidently slightly longer than the first. Abdomen as long as the head and thorax united, without a pubescent girdle at base.

Balthazar. Described from one female specimen.

Readily distinguished from the preceding species by the shorter antennæ and the relative length of same, shorter mesonotum, and the shape of the anterior wings.

HEXACOLA, Förster.

HEXACOLA DUBIA, sp. n.

♀. Length 1·2 mm. Polished black; antennæ black; mandibles rufous; legs reddish yellow.

Antennæ 13-jointed; funicle 5-jointed, the first joint nearly twice as long as the second, joints 2–4 subequal, the last the stoutest; club 6-jointed, fluted, the joints except the last about equal, a little longer than thick, the last ovate, longer than the others. Scutellum striate at sides; the cup small, elliptic, with a fovea posteriorly which occupies about half the surface. Wings hyaline, entire at apex, the veins light brown, the marginal vein open along the fore margin, the second abscissa of radius a little longer than the first. Abdomen with a sparse pubescent girdle at base.

Balthazar (windward side). Described from one female specimen.

HEPTAMERIS, Förster.

HEPTAMERIS FLAVIPES, sp. n.

♀. Length 1 mm. Polished black; antennæ, except the 7-jointed club, and legs yellow.

Antennæ 13-jointed, not quite so long as the body, the scape only a little longer than the pedicel; funicle 4-jointed, slender, the first joint the longest, not quite twice so long as the second, joints 2–4 subequal, longer than thick; club abrupt, 7-jointed, the joints subequal, about 2½ times as long as thick, fluted, the last joint slightly the longest. Mesonotum as long as wide at base; scutellum indistinctly striate, the cup oval, smooth on the disk, with a small fovea posteriorly and some punctures anteriorly. Wings hyaline; the veins yellowish, the anterior wings slightly emarginate at apex, the marginal cell closed along the fore margin for more than half its length, the second abscissa of radius 1½ times as long as the first. Abdomen black, a little longer than the thorax, with a slender pubescent girdle at base.

Balthazar. Described from one female specimen.

PARAMIOMŒA, Ashm., g. n.

♀. Antennæ 12-jointed, with an abrupt 7-jointed club; the scape obconical, only a little longer than the pedicel, which is rounded; funicle 3-jointed, the first joint not quite so long as the second and third united, which are moniliform; club 7-jointed, the joints about equal in size, strongly fluted. Scutellum rugose, the cup rather large, oval, the carina separating it from the mesonotum very short, the disk with a fovea posteriorly and a few punctures anteriorly. Wings with a closed marginal cell, the first abscissa of radius shorter than the second. Otherwise as in *Eucoela*.

This genus is distinguished from all other genera in the *Eucoelinæ*, except *Miomœa* and *Idiomorpha*, Förster, by having only 12-jointed antennæ, and from these two genera by its scutellar and antennal characteristics. In *Miomœa* the cup of the scutellum is large, rounded, with the whole disk impressed, while the antennæ are filiform, with the first flagellar joint the longest and curved. In *Idiomorpha* the marginal cell is closed, while the antennæ are also different.

PARAMIOMŒA HEPTATOMA, sp. n.

♀. Length 1·25 mm. Polished black; basal five joints of antennæ and legs brownish yellow; club-joints black, strongly fluted; clypeus and mandibles rufous. Wings hyaline, ciliate, the veins light brown, the marginal cell closed, not quite twice so long as wide, the first abscissa of radius less than two-thirds the length of the second. Abdomen with a faintly pubescent girdle at base.

Mount Gay Estate. Described from one female specimen.

AGLAOTOMA, Förster.

Table of Species.

Females.

Species more or less pale.. 3.
Species black, except sometimes the pleura.
  Coxæ and legs reddish or brownish yellow.
    Cup of scutellum small, narrow, ovate, or elliptic. 2.
    Cup of scutellum large, oval, rimmed.
      Antennæ much longer than the body, the 7 terminal joints black, fluted, about four times as long as thick .... *A. longicornis*, Ashm.
2. Antennæ longer than the body.
  Seven terminal joints black; abdomen at base piceous; pleura black .... *A. basalis*, Ashm.
  Six terminal joints black; abdomen black, except beneath at base; pleura piceous .... *A. similis*, sp. n.
3. Head black; thorax dark brown or rufo-piceous.
  Abdomen, legs, and first four joints of flagellum pale rufous.
    Antennæ not longer than the body, the 7 terminal joints slightly thicker than the preceding, the last one-third longer than the preceding ...... *A. variabilis*, Ashm.
  Reddish brown or pale ferruginous, the head with the vertex and occiput only black.
    Antennæ longer than the body, joints 1–6 reddish yellow, joints 7–11 brown-black, joints 12–13 white .... *A. tricolor*, sp. n.
    Antennæ longer than the body, the 8 terminal joints a little thicker than the preceding, the last one-half longer than the penultimate............... *A. pallida*, Ashm.

Males.

Species more or less pale .... 2.
Species mostly black; coxæ and legs reddish or brownish yellow.
  Antennæ brown-black, 1¾ times the length of body, the first flagellar joint not quite twice as long as the second, the third and following joints subequal, a little longer than the second, and slightly more than 3 times as long as thick, longitudinally striate; metathorax black .... *A. similis*.
  Antennæ, except scape, brown, nearly twice as long as the body, the first flagellar joint about twice as long as the second, stout and slightly curved, the second and last joints equal, the intermediate joints 3 times as long as thick, all fluted; metathorax pale .... *A. basalis*, Ashm.
2. Thorax rufo-piceous; head and abdomen black.
  First flagellar joint slightly longer than the fourth, the joints beyond about 4 times as long as thick. *A. pallida*, Ashm.

(1) AGLAOTOMA SIMILIS, sp. n.

♀. Length 1·4 mm. Polished black, the pleura more or less piceous; antennæ, except the six terminal joints, and legs brownish yellow; mandibles reddish yellow.

Antennæ 13-jointed, longer than the body; the flagellar joints long, cylindrical, the seven terminal joints stouter than the preceding and forming a more or less distinct club; scape only 1½ times as long as the pedicel; flagellar joints 1, 2, and 5 subequal, a little shorter than joints 3 and 4, joints 6 to 12 subequal, stouter, from 3½ to 3 times as long as thick, the 12th joint the shortest, joint 13 ovate, one-third longer than the 12th, joints 8 to 13 fluted. Scutellum rugoso-punctate; the cup small, ovate, produced into a carina anteriorly, rimmed, the rim piceous or ferruginous. Metanotum bicarinate, the carinæ widely separated, clothed with a glittering white pubescence. Wings hyaline, the tegulæ and veins brownish yellow, the marginal cell closed, nearly twice as long as wide, the first abscissa of radius about two-thirds the length of the second. Abdomen not quite so long as the head and thorax united, piceous beneath toward base, and with a hairy girdle.

♂. Length 1 mm. Polished black; mandibles and legs reddish yellow. Antennæ 15-jointed, brown-black, 1¾ times the length of body, the scape not quite twice so long as the pedicel, the first flagellar joint not quite twice so long as the second, a little curved, the second and third subequal, a little shorter than the following joints, which are a little more than three times as long as thick.

Balthazar and Grand Étang. Described from one male and one female specimen.

(2) AGLAOTOMA TRICOLOR, sp. n.

♀. Length 1 mm. Reddish brown, the head having the vertex and occiput black; legs and basal six joints of antennæ brownish yellow; antennal joints 7–11 brown-black, 12 and 13 white.

Antennæ 13-jointed, longer than the body, the 7 terminal joints a little stouter than the preceding, and forming a cylindrical club; all joints cylindrical, the first joint of flagellum a little longer than the second, the third and fourth longer than the first, the fifth a little stouter and a little shorter than the fourth, the following joints slightly longer, a little more than three times as long as thick. Scutellum finely punctate; the cup small, ovate, with a small fovea posteriorly. Wings hyaline, strongly fringed. Abdomen as long as the thorax, with a slight woolly girdle at base.

Balthazar. Described from one female specimen.

CHRESTOSEMA, Förster.

(1) CHRESTOSEMA PALLIDIPES, Ashm. Journ. Linn. Soc., Zool. vol. xxv. p. 68.

Balthazar. A single female agreeing perfectly with the type from St. Vincent.

(2) CHRESTOSEMA FLAVIPES, sp. n.

♀. Length 1 mm. Polished black; antennæ, except first two joints, black or brown-black; legs yellow.

Antennæ 13-jointed, filiform, longer than the body; the scape and pedicel subequal, united not longer than the first joint of flagellum; first joint of flagellum slender, a little longer than the second, the second and following joints of equal thickness, pubescent, very slightly and almost imperceptibly shortening, the second being nearly three times as long as thick, the last about twice as long as thick.

Mesonotum scarcely as long as wide, with a narrow wedge-shaped elevation medially, anteriorly, and with a broad deep groove at sides over the tegulæ. Scutellum coarsely rugose, the cup large-oval, with a rather large fovea a little behind the middle, and with several punctures surrounding the margin. Metathorax abruptly declivous, bicarinate at the middle, and with a carina at the sides which separate the metapleura from the metanotum; mesopleura separated from the metapleura by a grooved line. Wings hyaline, the veins brownish yellow, the marginal cell closed, the second abscissa of radius about 1½ times as long as the first, curved outwardly, the first branch straight. Abdomen not longer than the thorax, black polished, with an elevated, slightly pubescent girdle at base.

Mount Gay Estate. Described from one female specimen.

This species is allied to *C. robusta*, Ashm., described from St. Vincent, but it is at once separated from it by the differences noticed in the antennæ, by the colour of the legs, and by the longer marginal cell.

RHOPTROMERIS, Förster.

RHOPTROMERIS ATRICLAVATA, sp. n.

♀. Length 1·1 to 1·3 mm. Polished black; antennæ, except the 7-jointed club, and legs brownish yellow or yellow; club black. Antennæ 13-jointed, a little shorter than the body, the 7 terminal joints thickened and forming a club, the joints being a little more than twice as long as thick; scape a little longer than the pedicel; funicle 4-jointed, the joints elongate, slender, the first slightly the longest, the others subequal. Cup of scutellum ovate, with a small fovea posteriorly and some punctures on the anterior part. Wings hyaline, ciliate, the veins yellowish, the first branch of the radius fully as long as the second, the marginal cell closed, and about twice as long as wide. Abdomen about as long as the head and thorax united, with a griseous woolly girdle at base, interrupted above; the base above is also more or less piceous.

Mount Gay Estate. Described from two female specimens.

TRYBLIOGRAPHA, Förster.

Marginal cell completely closed.
  Cup of scutellum rather large, oval, smooth, impunctate, except a small fovea posteriorly.
    Four or five basal joints of antennæ and legs reddish or brownish yellow .... *L. xanthopoda*

(1) Trybliographa xanthopoda, sp. n.

♀. Length 1·1 to 1·5 mm. Polished black; antennæ, except four or five basal joints, black or piceous black; basal joints of antennæ and legs reddish or brownish yellow.

Antennæ 13-jointed, gradually incrassated, the scape a little longer than the pedicel; first flagellar joint the longest and slenderest, and fully one-half longer than the second, the joints beyond gradually increasing in size from the third, second and third joints subequal, fourth, fifth, and sixth about equal in length, a little longer than the third, joints 7–10 a little shorter and stouter than the sixth, the last joint ovate. Cup of scutellum rather large, oval, smooth, polished, impunctate, with a small oval fovea posteriorly, the anterior part smooth and convex. Wings hyaline, ciliate, the veins yellow, the marginal cell completely closed, the first abscissa of radius a little shorter than the second, curved inwardly, the second almost straight, the cubitus distinct, curved downwards at base; the marginal cell is only about $1\frac{1}{2}$ times as long as wide. Abdomen a little shorter than the head and thorax together, with a narrow, sparsely pubescent girdle at base.

The male agrees with the female, except in having long, 15-jointed antennæ, with only the three basal joints rufous, the following all being piceous black, striated; the first joint of flagellum is slightly longer and stouter than the second, the second and following joints are equal, ellipsoidal, three times as long as thick.

Balthazar. Described from one male and two female specimens

Eucoela, Westwood.

Table of Species.

Females.

Marginal cell more or less open along the fore margin	4.
Marginal cell completely closed.	
Species reddish brown or ferruginous	3.
Species with head and thorax black, abdomen rufous	2.
Species black or mostly black.	
a. Cup of scutellum rather large, oval, its base almost touching the margin of mesonotum, with a fovea posteriorly, and usually some punctures on the smooth anterior part	
Six terminal joints of antennæ fuscous or black; rest of antennæ and legs reddish yellow; cup of scutellum with a transverse fovea behind, and a few punctures along the margin of anterior part	*E. ovalis*, Ashm.
Eight terminal joints of antennæ fuscous or black; rest of antennæ and legs reddish yellow; cup of scutellum with a rounded fovea posteriorly, the anterior part subconvex, polished, impunctate	*E. unifoveata*, sp. n.

aa. Cup of scutellum narrowed ovate, produced into a long carina anteriorly, the body of cup far away from the margin of mesonotum, with a fovea posteriorly, and the anterior part usually with some punctures along the margins.

Metapleura black.

Antennæ, except 3 or 4 apical joints which are fuscous, rufous; legs brownish yellow; anterior part of cup with a frenum formed by punctures................ *E. perplexa*, sp. n.

Antennæ, except 4 or 5 apical joints which are fuscous, and legs brownish yellow; anterior part of cup closely punctate, with no glabrous surface .... *E. obliterata*, sp. n.

Metapleura reddish or rufo-piceous; antennæ, except last four joints, and legs brownish yellow.

Metanotum with a deep channel on each side of the median carinæ; joints 3, 4, and 5 of flagellum only about twice as long as thick, obconical .... *E. canaliculata*, Ashm.
=*E. claripennis*, Ashm. (preoc.).

Metanotum without these channels; joints 3, 4, and 5 of flagellum fully thrice as long as thick .... *E. aliena*, sp. n.

2. Cup of scutellum broadly oval; the disk concave, and separated into two subequal parts by a transverse carina, and connected with the mesonotum by a longitudinal carina anteriorly; legs rufous .... *E. cressonii*, D. T.
=*E. basalis*, Cr.
=*E. rufiventris*, Cam.

3. Head and last five joints of antennæ black; scutellum rugose, the cup small, narrowed, produced into a carina anteriorly, punctate............ *E. atriceps*, sp. n.

4. Species black.

Cup of scutellum rather large, oval, with a small round fovea posteriorly; antennæ, except last two joints, and legs brownish yellow .... *E. inconstans*, sp. n.

Males.

Head and thorax black; abdomen mostly rufous.

Cup of scutellum broadly oval; the disk concave and separated into two parts by a transverse carina; antennæ long, black .... *E. cressonii*, D. T.

Head black; thorax and abdomen ferruginous.

Cup of scutellum broadly oval; the disk flat, smooth, with a small transverse fovea posteriorly, and about 4 punctures on anterior part; antennæ long, ferruginous .... *E. nigriceps*, sp. n.

Entirely ferruginous.

Cup of scutellum broadly oval, flat, smooth, with a large transversely oval shallow fovea posteriorly, and about 4 punctures on anterior part; antennæ long, dusky beyond the middle. *E. ferruginea*, sp. n.

(1) EUCOELA OVALIS, Ashm. Journ. Linn. Soc., Zool. vol. xxv. 1894, p. 76.

Mount Gay Estate, St. George's. Two female specimens.

(2) Eucoela unifoveata, sp. n.

♀. Length 1 to 1·2 mm. Polished black; antennæ, except the 8 terminal joints, and legs reddish yellow; 8 terminal joints of antennæ black or fuscous.

Antennæ 13-jointed, a little shorter than the body, the scape a little longer than the pedicel; the first flagellar joint the longest, nearly as long as the second and third united, the fourth, fifth, and sixth subequal, longer than the third, the following joints slightly shorter, but stouter, about twice as long as thick, the last ovate, very slightly longer than the penultimate; cup of scutellum oval, its disk subconvex, smooth, and polished, with a small rounded fovea posteriorly, the anterior part impunctate. Wings hyaline, ciliate, the veins yellowish, the marginal cell completely closed, about 1½ times as long as wide, the first branch of the radius a little shorter than the second. Abdomen a little longer than the thorax, with a slender pubescent girdle at base.

Balthazar. Described from three female specimens.

(3) Eucoela perplexa, sp. n.

♀. Length 1·5 mm. Polished black; antennæ, except 3 or 4 apical joints which are fuscous, rufous; legs brownish yellow.

Antennæ 13-jointed, extending to middle of abdomen, the scape about 1½ times as long as the pedicel, the latter rounded; first flagellar joint, except the large ovate terminal joint, the longest, 1½ times as long as the second, joints 3–7 imperceptibly shortening, but also thickening, joints 8–10 a little longer, oblong-oval, the last joint large, ovate, about twice as long as the penultimate. Cup of scutellum much narrowed, subovate, produced into a long carina anteriorly, the body of cup far away from the margin of mesonotum, with a small fovea posteriorly, the anterior part with 4 or 5 punctures. Wings hyaline, ciliate, the veins yellowish, the marginal cell completely closed, twice as long as wide; the apical branch of the submarginal vein nearly straight and forming almost a right angle with the outer margin, the second abscissa of radius about 1¾ times the length of the first. Abdomen a little longer than the thorax, with a dense griseous woolly girdle at base.

Balthazar. Described from one female specimen.

(4) Eucoela obliterata, sp. n.

♀. Length 1·5 mm. Polished black; antennæ, except 4 or 5 apical joints, and legs brownish yellow, apical joints black or fuscous; abdomen along the venter more or less piceous or rufous.

Antennæ 13-jointed, about as long as the body, the scape not quite twice as long as the pedicel; joints of flagellum 1–5 slender, subcylindrical, the first the longest, the following gradually shortening, the fifth, although the shortest, is a little the thickest; joints 6–10 subequal, about 2½ times as long as thick, the last ovate, not longer than the preceding; joints 6–11 strongly fluted. Scutellum coarsely rugose, the cup much narrowed, ovate, produced into a long carina anteriorly, and with the usual small fovea posteriorly, but anteriorly the usually glabrous surface is destroyed by small close punctures. Wings hyaline, ciliate, the veins yellowish, the marginal cell closed, about twice as long as wide, the apical branch of the submarginal vein straight but short, second branch of radius 1½ times as long as the first. Abdomen about as long as the head and thorax united, piceous or rufous along the venter, and with a greyish girdle of wool at base.

Balthazar, Mount Gay Estate. Described from three female specimens.

(5) EUCOELA CANALICULATA, Ashm.

Eucoela claripennis, Ashm. Journ. Linn. Soc., Zool. vol. xxv. 1894, p. 76.

This early opportunity is taken to change the name of a species described from St. Vincent, which I find is preoccupied by Thomson.

(6) EUCOELA ALIENA, sp. n.

♀. Length 1·2 mm. Allied to *E. obliterata*, but differs in having the collar at sides, the metapleura and metanotum, as well as the venter and base of abdomen, rufous or piceous, but otherwise, in structural characters, it is apparently identical.

Mount Gay Estate. Described from one female specimen.

This species may be only a variety of *E. obliterata.*

(7) EUCOELA CRESSONII, D. T.

Eucoila basalis, Cr. Proc. Ent Soc. Phil. iv. p. 5 (1862).

Eucoela cressonii, Dalla Torre, Wien. ent. Zeit. xi. p. 131 (1892); D. T. Cat. Hym. ii. p. 17 (1893).

? *Eucoila rufiventris*, Cam. Mem. Proc. Manch. Lit. Phil. Soc. (4) ii. p. 68 (1889).

? *Eucoela insularis*, D. T. Wien. ent. Zeit. xi. p. 132 (1892); Cat. Hym. ii. p. 18 (1893).

Hab. Cuba, Trinidad, St. Vincent, and Grenada.

This species was previously recognized, in both sexes, from St. Vincent, and now from three female specimens in the Grenada material, from Balthazar and Mount Gay Estate.

I cannot separate the species from *E. rufiventris*, Cameron, described from Trinidad, and it is believed the above synonymy will be found correct.

(8) EUCOELA ATRICEPS, sp. n.

♀. Length 1 mm. Head black; thorax and abdomen reddish brown or dark ferruginous; 5 apical joints of antennæ black, rest of antennæ and legs brownish yellow.

Antennæ 13-jointed, as long as the body, the scape a little longer than the pedicel, the first joint of flagellum only slightly longer than the second, about three times as long as thick, the third very little shorter than the second, the fourth and following joints increasing in length to the seventh, joints 8, 9, and 10 subequal, only a little shorter than the eighth, the last ovate, scarcely longer than the penultimate. Cup of scutellum narrowed ovate, produced into a carina anteriorly, its disk with a single small fovea or puncture. Wings hyaline, ciliate, the veins yellowish, the marginal cell closed, a little more than 1½ times longer than wide, the second branch of radius slightly the longest. Abdomen a little longer than the thorax, with a distinct but narrow girdle of greyish wool at base.

Mount Gay Estate. Described from one female specimen.

(9) EUCOELA NIGRICEPS, sp. n.

♂. Length 1·6 mm. Coloured as in preceding species (*E. atriceps*), but much larger; the antennæ 15-jointed, long, filiform, nearly twice the length of body, dusky only toward tips; the joints of flagellum all long, cylindrical, but very imperceptibly shortening, the last being the shortest and only about two-thirds the length of the first, the first scarcely longer than second; the pedicel rounded, not longer than thick; the scape subglobose, very little longer than thick. Cup of scutellum large, oval, with a transverse fovea posteriorly, the smooth anterior part with about four small punctures. Wings hyaline, ciliate, the veins yellowish, the marginal cell closed, about twice as long as wide, the second abscissa of radius being 1¾ times as long as the first.

Mount Gay Estate. Described from one male specimen. Although closely resembling *E. atriceps* in colour, it cannot possibly be the opposite sex of that species, since it is larger, has a different shaped scutellar cup, and a much longer marginal cell.

(10) EUCOELA FERRUGINEA, sp. n.

♂. Length 1·6 mm. Uniformly reddish brown or ferruginous, the flagellum dusky, while the legs are brownish yellow.

Except in the colour of the head it resembles *E. nigriceps*, but the antennæ are a little shorter, with the joints of the flagellum of an equal length, the first being slightly curved or bent, when viewed from the side, while the cup of the scutellum is broadly oval, its fovea posteriorly transversely oval and very shallow. Wings as in previous species.

Mount Gay Estate. Described from one male specimen.

(11) EUCOELA INCONSTANS, sp. n.

♀. Length 1·3 mm. Polished black; antennæ, except scape and last two or three joints, and legs brownish yellow.

Antennæ 13-jointed, subclavate, submoniliform, the first joint of flagellum obconic, twice as long as the second, which is only a little longer than thick, joint 3 a little longer than the second, joint 4 longer than third and thicker, the joints beyond submoniliform, a little longer than thick; cup of scutellum large, broadly oval, smooth and polished, with a single round fovea on posterior part. Wings hyaline, ciliate, the venation yellowish, the marginal cell open along the fore margin, nearly twice as long as wide, the second abscissa of radius about 1½ times as long as the first and slightly curved outwardly. Abdomen black, with a narrow pubescent girdle at base.

The ♂ differs only in having 15-jointed, brown-black antennæ, with the two basal joints rufous. All the joints of the flagellum are about equal in length, striated, about 3½ times as long as thick; while the rounded fovea on the cup of scutellum is a little larger.

Balthazar and Mount Gay Estate. Described from one male and one female specimen.

HEPTAMEROCERA, Ashmead, g. n.
(Type, *H. robusta.*)

Antennæ in ♀ 13-jointed, shorter than the body, terminating in an abrupt 7-jointed club. Scutellum closely punctate or rugose, the cup oval or ovate, with a small fovea posteriorly. Front wings with the marginal cell either open or closed, the first abscissa of radius shorter than the second, the cubitus entirely absent. Abdomen with the usual hair-fringe or girdle at base.

In having a 7-jointed antennal club, this genus approaches nearest to *Rhoptromeris*, Förster, but it is readily separated from it by the first abscissa of radius being shorter than the second and by the first joint of the flagellum being longer than the second. From *Heptameris*, Förster, which also has a 7-jointed club, it is distinguished by the great difference noticeable in the shape of the marginal cell, the sculpture of the scutellum, and by the shape of the scutellar cup.

The species placed here may be tabulated as follows:—

Table of Species.

Females.

- Marginal cell more or less open along the fore margin .... 2.
- Marginal cell completely closed.
  - Abdomen rufous; head and thorax black.
    - Cup of scutellum large, oval; club-joints dusky; legs yellow .... *H. bicolor*, sp. n.
  - Abdomen black.
    - Metapleura black.
      - Cup of scutellum very minute, elliptic, with the disk foveated; mesonotum with a large fovea just in front of the scutellum.
        - First funiclar joint minute, obconic, not much longer than thick, joints 2–4 moniliform; club-joints oblong, fully twice as long as thick .... *H. singularis*, sp. n.

Cup of scutellum ovate, with a fovea posteriorly; antennæ, except club, rufous or reddish yellow; legs brownish yellow.

First funiclar joint twice as long as the second, joints 2–4 obconical, subequal, at least twice as long as thick at apex; club-joints oblong, 1½ times as long as thick .... *H. robusta*, sp. n.

First funiclar joint only a little longer than the second; joints 2–4 long, cylindric, subequal, about 3½ times as long as thick .... *H. gracilicornis*, sp. n.

Metapleura and metanotum red.

Cup of scutellum ovate, with a fovea posteriorly and about 6 punctures anteriorly.

First flagellar joint about 3 times as long as thick, the following a little shorter, subequal in length but becoming a little stouter; antennæ, except last 4 joints, and legs yellow .... *H. xanthognatha*, sp. n.

2. Cup of scutellum ovate, with a fovea posteriorly and about 4 punctures anteriorly.

Antennæ, except club, rufous; legs brownish yellow; first joint of flagellum about twice as long as the second, joints 3–4 very little longer than thick .... *H. aliena*, sp. n.

Cup of scutellum oval, with a round fovea a little behind the middle.

Antennæ, except scape and 1 or 2 apical joints, and legs brownish yellow; first joint of flagellum longer than the second, 2–3 shortening, the fourth as long as the first............................... *H. flavicornis*, sp. n.

(1) HEPTAMEROCERA BICOLOR, sp. n.

♀. Length 1 mm. Head and thorax polished black; abdomen rufous; antennæ, except club, rufous; legs brownish yellow.

Antennæ 13-jointed, nearly as long as the body; funicle 4-jointed, the first joint very little longer than the second, the others subequal in length but slightly stouter; club-joints subequal, a little more than three times as long as thick. Cup of scutellum rather large, oval, the channel surrounding it striated; metanotum punctate. Wings hyaline, pubescent, the veins testaceous, the marginal cell closed, the first abscissa of radius not much shorter than second, and slightly bowed inwardly, the second abscissa straight and slightly thickened. Abdomen not quite as long as the head and thorax united, with a sparse hair-fringe at base.

Mount Gay Estate (leeward side). Described from one female specimen.

(2) HEPTAMEROCERA SINGULARIS, sp. n.

♀. Length 0·75 mm. Polished black; antennæ, except club, and legs brownish yellow; club brown.

Antennæ 13-jointed, very nearly as long as the body; pedicel oblong, larger than scape; funicle 4-jointed, the first joint only a little longer than thick, the second, third, and fourth moniliform; club-joints subequal, 2½ times as long as thick. Scutellum finely closely punctate, the cup very small, elliptic, the disk foveated. Wings hyaline, ciliate, the veins brownish yellow, the marginal cell closed, about 1½ times as long as wide, the second abscissa of radius a little longer than the first. Abdomen a little longer than the thorax, ovate, subcompressed, with a sparse hair-fringe at base.

St. George's (leeward side). Described from one female specimen.

(3) HEPTAMEROCERA ROBUSTA, sp. n.

♀. Length 1·5 mm. Polished black; antennæ, except club, rufous; legs brownish yellow; mandibles rufous.

Antennæ 13-jointed, extending a little beyond the middle of abdomen; funicle 4-jointed, the first joint twice as long as the second, joints 3–4 obconical, subequal, twice as long as thick; club-joints, except the last which is ovate and a little the longest, subequal, about twice as long as thick. Scutellum rugose, the cup ovate, with a transverse fovea posteriorly and some punctures on the anterior part, the rim piceous or reddish. Wings hyaline, ciliate, the veins brownish yellow, the marginal cell closed, the second abscissa of radius being nearly 1½ times as long as the first. Abdomen as long as the thorax, with a dense griseous woolly girdle at base.

Vendôme Estate (leeward side). Described from one female specimen.

(4) HEPTAMEROCERA GRACILICORNIS, sp. n.

♀. Length 1·2 mm. Polished black; antennæ, except club, and legs brownish yellow.

Antennæ 13-jointed, rather slender, nearly as long as the body; funicle 4-jointed, the joints slender, cylindrical, the first joint very little longer than the second, the following subequal, about 3½ times as long as thick; club-joints about 2½ times as long as thick, the last ovate, not longer than the penultimate. Scutellum closely punctate, the cup ovate, with a small fovea posteriorly and several punctures anteriorly. Wings hyaline, ciliate, the veins brownish yellow, the marginal cell closed, the first abscissa of radius only a little shorter than the second, slightly curved inwardly, the second straight and stouter. Abdomen scarcely longer than the thorax, with a sparse hair-fringe at base.

Mount Gay Estate (leeward side). Described from four female specimens.

(5) HEPTAMEROCERA XANTHOGNATHA, sp. n.

♀. Length 1·2 mm. Polished black, the metapleura and metanotum red; antennæ, except last four joints, the legs, and the mandibles yellow.

Antennæ 13-jointed, as long as the body; funicle 4-jointed, the first and fourth joints equal, the second and third shorter, about two-thirds the length of the first; club-joints nearly equal, about twice as long as thick, the last ovate and slightly longer than the others. Scutellum rugose, piceous, the cup ovate, with a rounded fovea posteriorly, and from 4 to 6 punctures on the smooth anterior part. Wings hyaline, ciliate, the veins yellowish, the marginal cell closed, about twice as long as wide, the second abscissa of radius 1½ times as long as the first. Abdomen a little longer than the thorax, piceous at base, the hair-fringe not dense.

Mount Gay Estate (leeward side). Described from one female specimen.

(6) HEPTAMEROCERA ALIENA, sp. n.

♀. Length 1·2–1·3 mm. Polished black; antennæ, except the club, rufous; legs brownish yellow.

Antennæ 13-jointed, not longer than the thorax; funicle 4-jointed, the first joint about twice as long as the second, the third and fourth only a little longer than thick; club-joints, except the last, oblong, about 1½ times as long as thick, the last ovate, a little longer than the penultimate; all club-joints strongly fluted. Scutellum closely punctate, the cup ovate, with a large deep fovea posteriorly and from 4–6 punctures anteriorly, margins pale. Wings hyaline, ciliate, the veins pale, the marginal cell, except at base, one-third open along the fore margin and about twice as long as wide; the first abscissa of radius is slightly bent inwardly and about two-thirds the length of the second. Abdomen a little longer than the thorax, with a whitish pubescent girdle at base.

Mount Gay Estate (leeward side) and Balthazar (windward side). Described from four female specimens.

(7) HEPTAMEROCERA FLAVICORNIS, sp. n.

♀. Length 1·2–1·4 mm. Polished black; antennæ, except basal joint and one or two apical joints which are more or less dusky, and legs yellow.

Antennæ 13-jointed, a little shorter than the body; funicle 4-jointed, the first and fourth joints equal, about 2½ times as long as thick at apex, the second and third also equal, but only 1½ times as long as thick; club-joints, except the last which is ovate and the largest joint, oblong, about 1½ times as long as thick, the first joint being the slenderest. Cup of scutellum rather large, oval, with a small rounded but not deep fovea a little behind the middle, the disk flat, impunctate, anteriorly sloping but convex (one specimen has the cup of scutellum highly convexly elevated posteriorly, probably from an accident or defect in pupation, since otherwise it agrees with the typical form). Wings hyaline, ciliate, the venation as in previous species. Abdomen with a sparse griseous pubescence at base.

Balthazar (windward side). Described from four female specimens.

HEXAPLASTA, Förster.

Table of Species.

Females.

Marginal cell entirely closed .... 3.

Marginal cell more or less open along the fore margin .... 2.

2. Cup of scutellum rather small, ovate, with a small fovea posteriorly and from 2 to 4 punctures on anterior part.

Antennæ black.

Legs brownish yellow; joints of funicle 2–5 obconic, subequal, 1½ times as long as thick at apex; club-joints oblong, not twice as long as thick .... *H. melanocera*, sp. n.

Legs red; joints of funicle 2–5 subequal, fully twice as long as thick; club-joints twice as long as thick .... *H. consimilis*, sp. n.

Antennæ, except club and sometimes the scape and pedicel, rufous, the club black or piceous black; legs brownish yellow or yellow.

Joints 2–5 of funicle not, or very little, longer than thick; club-joints rounded, not, or very little, longer than thick, except the last which is ovate, 1½ times as long as thick .... *H. modesta*, Ashm.

Joints 2–5 of funicle about twice as long as thick; club-joints oblong.................. *H. sancti-vincenti*, Ashm.

Antennæ, except club, and legs brownish yellow.

Joints 2–5 of funicle 1¼ times as long as thick; club-joints oblong, the last ovate, longer than the preceding .... *H. affinis*, sp. n.

Joints 2–5 of funicle cylindrical, subequal, nearly 3 times as long as thick; club-joints about 2½ times as long as thick .... *H. longicornis*, sp. n.

Antennæ, except last 5 joints of club which are fuscous or dark brown, and legs brownish yellow.

Joints 2–5 of funicle obconic, twice as long as thick at apex, or nearly so; club-joints nearly twice as long as thick, the last ovate and a little longer .... *H. crassinervis*, sp. n.

Antennæ, except last 4 joints of club which are fuscous, and the legs brownish yellow.

Joints 2–5 of funicle moniliform, not longer than thick; club-joints very little longer than thick, gradually increasing in size .... *H. 4-punctata*, sp. n.

Cup of scutellum exceedingly narrow, elliptic or almost a carina, with a minute fovea posteriorly, the channels at the sides striated.

Antennæ, except the funicle which is rufo-piceous, black; legs reddish yellow.

Joints 2–5 about twice as long as thick; club-joints oblong, about 1½ times as long as thick .... *H. striatiscutellaris*, sp. n.

3. Cup of scutellum ovate or subelliptic, with a small fovea posteriorly, and 2–4 or more punctures on the anterior part.................. 4

Cup of scutellum rounded or broadly oval ...... 5.

Cup of scutellum small, exceedingly narrowed, merely a ridge with a single puncture, and produced into a long carina anteriorly.

Antennæ, except the 4 or 5 terminal joints which are fuscous or black, and legs brownish yellow.

Joints of funicle 2–5 long, about 3½ times as long as thick at apex; club-joints a little more than twice as long as thick.. *H. tenuicornis*, sp. n.

Antennæ, except club which is fuscous or black, and legs yellow or brownish yellow.

Joints 2–5 of funicle subequal, about 1½ times as long as thick or a little longer; club-joints not quite twice as long as thick .... *H. unifoveata*, sp. n.

Joints 2–5 of funicle subequal, not, or only a little, longer than thick; club-joints slightly longer than thick; metapleura and metanotum rufous, the former bounded by a sharp carina .... *H. instabilis*, sp. n.

4. Thorax and abdomen yellowish brown; head black.

Antennæ, except club, brownish yellow; joints 3–5 of funicle moniliform; club-joints rounded .... *H. atriceps*, Ashm.

Thorax at sides rufous or dark piceous, the metapleura always red.

Antennæ, except last 5 joints, and legs brownish yellow; joints 2–5 of funicle very little longer than thick, obconic; club-joints not, or only slightly, longer than thick .... *H. rufolateralis*, sp. n.

Antennæ, except club which is fuscous, and legs brownish yellow; joints 2–5 of funicle cylindric, about 3 times as long as thick; club-joints 2½ times as long as thick .... *H. brunneiclavata*, sp. n.

Thorax at sides black.

Antennæ black, the funicle rarely piceous; legs yellow or brownish yellow.

Joints 2–5 of funicle subequal, a little longer than thick; club-joints, except the last which is ovate and twice as long as thick, oblong; second abscissa of radius 1¾ times as long as the first............... *H. hexomera*, sp. n.

5. Cup of scutellum rounded, without a fovea posteriorly, and connected with the mesonotum by a carina; basal foveæ crenated.

Antennæ, except club, and legs reddish yellow.

Joints 2–5 of funicle subequal, a little longer than thick; club-joints, except the last which is ovate and twice as long as thick, only a little longer than thick .... *H. incongrua*, sp. n.

Cup of scutellum oval, with a fovea posteriorly and with from 2–4 punctures on anterior part.

Antennæ, except last 5 joints of club, and legs brownish yellow.
Sides of thorax rufous or piceous; metapleura always red.
Joints 2–5 of funicle three or more times longer than thick; club-joints twice as long as thick .... *H. pleuralis*, sp. n.
Sides of thorax black.
Joints 2–5 of funicle subequal, twice as long as thick or a little longer; club-joints, except the last which is ovate and larger than the others, about 1½ times as long as thick .... *H. proxima*, sp. n.
Antennæ black, the funicle sometimes piceous; legs brownish yellow.
Joints 2–5 of funicle subequal, scarcely 1½ times as long as thick; club-joints, except the last, a little longer than thick .... *H. dubiosa*, sp. n.
Antennæ always black; legs yellowish.
Joints 2–5 of funicle very little longer than thick; club-joints oblong, the last ovate, much longer than the preceding; second branch of radius nearly twice as long as the first, marginal cell 3 times as long as wide .... *H. incerta*, sp. n.

Males.

Marginal cell entirely closed .... 2.
Marginal cell more or less open along the fore border.
Cup of scutellum small, ovate, with a small fovea posteriorly and from 2–4 punctures on the anterior part; antennæ black or piceous black.
Legs honey-yellow, with the femora toward base more or less obfuscated; first joint of flagellum twice as long as the second, stout, curved, the third a little longer than the second, the fourth and following joints a little longer than the third, subequal, a little more than twice as long as thick .... *H. melanocera.*
Legs reddish yellow; first joint of flagellum only 1½ times as long as the second, the second and third joints equal, the fourth and following joints a little longer than the third, equal, fully 3 times as long as thick................................ *H. consimilis.*
Legs brownish yellow; first joint of flagellum not much longer than the second, stouter, the third a little longer than the second, the fourth and following joints about twice as long as thick ... *H. modesta.*
2. Cup of scutellum ovate or subelliptic, with a small fovea posteriorly and 2–4 or more punctures on the anterior part .... 3.
Cup of scutellum rounded or broadly oval .... 4.
Cup of scutellum minute, exceedingly narrowed, merely a ridge with a single small fovea or puncture.
Antennæ, except slightly toward tips, and legs brownish yellow.
First joint of flagellum one-half longer than the second, the third and following joints scarcely longer than the second and 3 times as long as thick .... *H. tenuicornis.*

First joint of flagellum about one-half longer than the second, the third and following joints hardly longer than the second and about 2½ times as long as thick .... *H. unifoveata.*

Antennæ uniformly dark brown or blackish.

Metapleura black, the scutellar channels striated.

First joint of flagellum long, nearly twice as long as the second, the third and following joints about equal, a little longer than the second, 3 times as long as thick .... *H. dolichomera.*

Metapleura reddish, the scutellar channels closely punctate.

First joint of flagellum only one-half longer than the second, the third and following about 3 times as long as thick............... *H. instabilis.*

3. Thorax at sides rufous or brownish piceous, the metapleura always red.

Antennæ brown, the three or four basal joints and the legs brownish yellow.

First joint of flagellum one-third longer than the second, the third and following joints not or scarcely longer than the second, almost 3 times as long as thick .... *H. rufolateralis.*

Thorax at sides black.

Antennæ slender, brown, the three basal joints and legs brownish yellow.

First joint of flagellum one-half longer than the second, the following joints about equal, fully 3 times as long as thick .... *H. brunneiclavata.*

4. Antennæ black; legs brownish yellow.

First joint of flagellum one-half longer than the second, the third and following joints about 4 times as long as thick .... *H. proxima.*

(1) HEXAPLASTA MELANOCERA, sp. n.

♀. Length 1 to 1·2 mm. Polished black; mandibles and legs brownish yellow; metanotum with a sparse griseous pubescence.

Antennæ 13-jointed, black, extending to middle of abdomen; the scape clavate, about 1½ times as long as the pedicel, the latter a little longer than thick; funicle 5-jointed, the first joint more than twice as long as thick, joints 2–5 obconic, subequal, about 1½ times as long as thick, or nearly so; club 6-jointed, the joints oblong, not twice as long as thick, the first the thinnest, the last the stoutest. Mesonotum very little longer than wide at base, the collar with some sparse glittering hairs at the sides; scutellum finely rugose, the cup ovate, with a fovea posteriorly and 4 punctures on the anterior part. Wings hyaline, ciliate, the veins brownish yellow, the marginal cell open along its fore margin from the basal one-third, the second abscissa of radius only slightly longer than the first and slightly stouter, the outer vein of the areolet alone present. Abdomen a little longer than the thorax, with a griseous pubescent girdle at base, not interrupted at middle above.

♂. Length 0·9 mm. Antennæ 15-jointed, filiform, about 1¾ times as long as the body, black; the first joint of the flagellum is twice as long as the second, rather stout and a little curved; the third is a little longer than the second, while the fourth and following joints are a little longer than the third, subequal, a little more than twice as long as thick. The legs have the femora toward base more or less obfuscated; otherwise as in the female.

Mount Gay Estate (leeward side) and Grand Étang (windward side). Described from one male and three female specimens.

(2) HEXAPLASTA CONSIMILIS, sp. n.

♀. Length 1·25 mm. Differs from previous species as follows:—The form is slightly more robust, the antennæ are slightly longer, extending nearly to the tip of the abdomen, joints 2–5 of funicle as well as the club-joints fully twice as long as thick; the scutellum is more finely rugose, with striæ in the side channels at base; the outer vein of the areolet is wanting or only slightly developed; while the legs are more reddish.

The ♂ is 1 mm. long, the first joint of the flagellum only 1½ times as long as the second, the second and third joints equal or nearly so, while the following joints are fully three times as long as thick; otherwise, in colour of legs &c., it agrees with the female.

Grand Étang and Balthazar (windward side). Described from one female and two male specimens.

(3) HEXAPLASTA MODESTA, Ashm.

Hexacola modesta, Ashm. Journ. Linn. Soc., Zool. xxv. 1894, p. 73.

On account of the open radial cellule this species was originally described under the genus *Hexacola*. It is well represented in the Grenada material by 17 female specimens taken at Mount Gay Estate (leeward side) and Balthazar (windward side).

(4) HEXAPLASTA SANCTI-VINCENTI, Ashm.

Hexacola sancti-vincenti, Ashm. *l. c.* p. 74.

Mount Gay Estate (leeward side) and Balthazar (windward Eight female specimens.

(5) HEXAPLASTA AFFINIS, sp. n.

♀. Length 1 to 1·2 mm. Polished black; antennæ, except club which is usually fuscous, and legs brownish yellow.

Antennæ 13-jointed, a little shorter than the body, the scape obconic, 1½ times as long as the pedicel; funicle 5-jointed, the first joint about twice as long as thick or a little longer, joints 2–5 about 1¼ times as long as thick; club-joints oblong, the last ovate, longer than the preceding. Scutellum rugose, the cup ovate, with a small fovea posteriorly and 4 punctures on anterior part. Wings hyaline, ciliate, the venation pale yellowish, the marginal cell open along the fore margin from the basal one-third, the second abscissa only a little longer than the first, slightly curved, the first straight;

outer vein of areolet absent. Abdomen with a whitish girdle at base.

Balthazar (windward side), Mount Gay Estate, and St. John's River (leeward side). Described from five female specimens.

(6) HEXAPLASTA LONGICORNIS, sp. n.

♀. Length 1·1 to 1·25 mm. Polished black; antennæ, except club which is black or dark fuscous, and legs brownish yellow.

Antennæ 13-jointed, a little longer than the body, the joints of funicle all long, the first joint four times as long as thick, the following three times as long as thick; club-joints 2½ times as long as thick. Scutellum with the channels on each side striated, the posterior part finely rugose, the cup narrowed ovate, with four punctures. Wings hyaline, ciliate, the veins pale yellowish, the marginal cell along the fore margin, except at basal one-third, open; the second abscissa of radius straight, a little longer than the first, the first abscissa having a slight downward curve. Abdomen piceous beneath toward base, with a sparse hairy girdle.

Balthazar (windward side) and Mount Gay Estate (leeward side). Described from four female specimens.

(7) HEXAPLASTA CRASSINERVIS, sp. n.

♀. Length 0·9 mm. Polished black; antennæ, except last 5 joints which are fuscous, and legs brownish yellow.

Antennæ 13-jointed, a little shorter than the body; joints of funicle 2–5 obconic, about twice as long as thick. Scutellum finely rugulose, the cup small, ovate, with a small fovea posteriorly and about four punctures anteriorly. Wings hyaline, ciliate, the veins light brown, the marginal cell along the fore margin open beyond the base, the second abscissa of radius very little longer than the first but twice as stout. Abdomen with a sparse pubescent girdle at base.

Mount Gay Estate (leeward side). Described from two female specimens.

(8) HEXAPLASTA 4-PUNCTATA, sp. n.

♀. Length 0·8 mm. Polished black; antennæ, except last 4 joints of club which are fuscous, and legs brownish yellow.

Antennæ 13-jointed, extending to middle of abdomen or a little beyond the middle; first joint of funicle nearly 3 times as long as thick, joints 2–5 moniliform, not longer than thick; club-joints very little longer than thick, but gradually increasing in size, the last much the largest joint. Cup of scutellum small, ovate, with four minute punctures. Wings hyaline, ciliate, the veins brown, the marginal cell, except at basal one-third, open along the fore margin, the second abscissa of radius only a little longer than the first. Metapleura pubescent; the abdomen with the usual woolly girdle at base.

Balthazar (windward side). Described from one female specimen.

(9) HEXAPLASTA STRIATISCUTELLARIS, sp. n.

♀. Length 1·2 mm. Polished black; antennæ, except the funicle which is rufo-piceous, black; legs reddish yellow.

Antennæ 13-jointed, two-thirds the length of body, the first joint of funicle about 3 times as long as thick at apex, joints 2–5 twice as long as thick; club-joints oblong, about 1½ times as long as thick. Cup of scutellum exceedingly narrowed, elliptic, almost a carina, with a fovea posteriorly and one puncture on the anterior part, the channels at sides striated, the posterior part rugose. Wings hyaline, ciliate, the veins yellowish, the marginal cell as in the previous species. Abdomen as long as the thorax, with a narrow pubescent girdle at base.

Balthazar (windward side). Described from one female specimen.

In the very narrow scutellar cup and the striated sides of the scutellum this species bears a close resemblance to those species of *Kleidotoma* belonging to the subgenus *Hexacola*, Först.

(10) HEXAPLASTA TENUICORNIS, sp. n.

♀. Length 1·5 mm. Polished black; antennæ, except the 4 or 5 terminal joints which are fuscous or black, and legs brownish yellow; venter piceous.

Antennæ 13-jointed, as long as the body, the first joint of funicle 4 times as long as thick, the second and following joints about 3½ times as long as thick; club-joints a little more than twice as long as thick. Scutellum rugose, the cup small, exceedingly narrowed, merely a carina with a single puncture and produced into a long carina anteriorly. Wings hyaline, ciliate, the veins, except the submarginal vein at base which is yellowish, brown, the marginal cell completely closed, the second abscissa of radius about 1½ times as long as the first. Abdomen black above, piceous or reddish beneath, with a sparse pubescent girdle at base.

The male, or rather what is taken to be the male of this species, measures 1·25 mm. in length, is black, with the antennæ, except toward tips, and the legs brownish yellow. The first joint of the flagellum is one-half longer than the second, the third and following joints being scarcely longer than the second and nearly three times as long as thick.

Mount Gay Estate (leeward side). Described from one male and one female specimen.

(11) HEXAPLASTA UNIFOVEATA, sp. n.

♀. Length 1·2 mm. Polished black; antennæ, except club which is fuscous or black, and legs yellow or brownish yellow.

Antennæ 13-jointed, extending a little beyond the middle of abdomen; first joint of funicle about 2½ times as long as thick, joints 2–5 about 1½ times as long as thick or a little longer; club-joints not quite twice as long as thick. Cup of scutellum small, narrowed, with a small fovea posteriorly, the part before the fovea subconvex.

Wings hyaline, ciliate, the veins brown, the marginal cell closed, the second abscissa of radius very slightly longer than the first, the areolet indicated by a rounded stigma. Abdomen a little longer than the thorax, with a narrow girdle of sparse pubescence at base.

♂. Length 1 mm. Differs from female only in the antenuæ; these are 15-jointed, filiform, about 1½ times as long as the body, light brown, the three basal joints whitish; the first joint of flagellum is about one-half longer than the second, the third and following joints being scarcely longer than the second, or about 2½ times as long as thick.

Mount Gay Estate, St. George's (leeward side), and Balthazar (windward side). Described from two male and two female specimens.

(12) HEXAPLASTA DOLICHOMERA, sp. n.

♂. Length 1·3 mm. Differs from *H. unifoveata* in its larger size, in having longer, dark brown antennæ which are nearly twice as long as the whole insect; the first joint of the flagellum being long, nearly twice as long as the second, the third and following joints being slightly longer than the second, three times, or a little more than three times, as long as thick; the second abscissa of radius is 1½ times as long as the first; while the scutellar channels on each side of the cup are striated.

Mount Gay Estate (leeward side). Described from one male specimen.

(13) HEXAPLASTA INSTABILIS, sp. n.

♀. Length 1·25 to 1·5 mm. Robust, polished black, the sides of thorax and metathorax usually piceous or brownish, the metapleura always red, the mesopleura sometimes black; antennæ, except club which is fuscous or black, and legs brownish yellow.

Antennæ 13-jointed, the first joint of funicle a little more than twice as long as thick, joints 2–5 only a little longer than thick; club-joints, except last which is ovate and larger and stouter than the others, only slightly longer than thick. Scutellum closely reticulately punctate; the cup small, narrowed, with a minute fovea posteriorly. Wings hyaline, ciliate, the veins brown, the marginal cell closed, the second abscissa of radius about one-third longer than the first. Metapleura bounded by a distinct sharp carina behind. Abdomen piceous at base, the pubescent girdle at base nearly obliterated, only slightly indicated at sides or broadly interrupted at middle above.

♂. Length 1 mm. Antennæ 15-jointed, brown; the first joint of the flagellum one-half longer than the second, the third and following three times as long as thick; veins dark brown; otherwise as in the female.

Balthazar (windward side) and St. George's (leeward side). Described from one male and seven female specimens.

(14) HEXAPLASTA ATRICEPS, Ashm.

Ganaspis atriceps, Ashm. Journ. Linn. Soc., Zool. vol. xxv. p. 67.

This species, described from St. Vincent, belongs in reality to this genus. It was placed in the genus *Ganaspis* on account of having a closed marginal cell, since Förster described *Hexaplasta* with an *open marginal cell*; but the open or closed marginal cell in this group is of little generic importance and we must depend upon other characters for generic subdivision. These characters I hope to clearly define in a publication upon which I am at present engaged, and merely take this opportunity to place the above species in its proper genus.

(15) HEXAPLASTA RUFOLATERALIS, sp. n.

♀. Length 1 to 1·1 mm. Polished black, the sides of thorax, metanotum, and abdomen toward base beneath brown or brownish piceous; metapleura red; antennæ, except last 5 joints which are fuscous or black, and legs brownish yellow.

Antennæ 13-jointed; joints 2–5 of funicle obconic, very little longer than thick; club-joints, except the last, not, or only a little, longer than thick, the first the smallest, the following gradually increasing in size, the last ovate and the largest joint. Scutellum closely reticulately punctate; the cup large, ovate, with a small fovea posteriorly and 4 punctures anteriorly. Metapleura red or reddish, bounded by a carina behind. Wings hyaline, ciliate, the veins brown, the marginal cell closed, the second abscissa of radius not quite one-half longer than the first, the latter slightly curved. Abdomen with the woolly girdle at base entire, not interrupted above.

♂. Length 1 mm. Antennæ 15-jointed, brown, the three or four basal joints yellowish; the first joint of the flagellum is one-third longer than the second, the third and following joints hardly longer than the second and nearly three times as long as thick; otherwise as in female.

Chantilly, Balthazar (windward side), Mount Gay Estate, and St. George's (leeward side). Described from nine female and five male specimens.

Comes nearest to *H. instabilis* and might easily be confused with that species. The difference in the cup of the scutellum will, however, readily distinguish it.

(16) HEXAPLASTA BRUNNEICLAVATA, sp. n.

♀. Length 1·1 mm. Polished black; sides of thorax, metathorax, and abdomen, except the dorsum, brownish piceous; antennæ, except the club which is brown, and legs yellow or brownish yellow.

Antennæ 13-jointed, rather slender, nearly as long as the body; joints 2–5 of funicle cylindric, about 3 times as long as thick; club-joints 2½ times as long as thick. Scutellum finely rugose, the cup rather small, ovate, with a minute fovea posteriorly and two punctures anteriorly. Wings hyaline, strongly ciliate; the veins brownish yellow, the marginal cell closed, the second abscissa of radius very little longer than the first. Abdomen with only a sparse pubescent girdle at base.

♂. Length 1 mm. Polished black; antennæ 5-jointed, long, filiform, light brown, the three basal joints and the legs yellowish; first joint of flagellum one-half longer than the second, the following joints about equal, 3 times as long as thick; otherwise as in female.

St. John's (leeward side). Described from one male and one female specimen.

(17) Hexaplasta hexomera, sp. n.

♀. Length 1·4–1·6 mm. Polished black; antennæ, except sometimes the funicle, black, the funicle sometimes piceous; legs brownish or reddish yellow.

Antennæ 13-jointed, joints 2–5 of funicle subequal, a little longer than thick; club-joints, except the last which is ovate and twice as long as thick, a little longer than thick, or oblong. Scutellum rugose, the cup ovate, with a small fovea posteriorly and 4 small punctures anteriorly (2 on each side). Wings hyaline, ciliate, the veins brownish yellow, the marginal cell closed, the second abscissa of radius 1¾ times as long as the first. Abdomen nearly as long as the head and thorax united and almost devoid of pubescence at base.

Chantilly and St. John's River. Described from two female specimens.

(18) Hexaplasta incongrua, sp. n.

♀. Length 1·5 mm. Polished black; antennæ, except club and legs, reddish yellow.

Antennæ 13-jointed, not extending beyond the middle of abdomen; the first joint of funicle twice as long as thick, joints 2–5 a little longer than thick; club-joints, except the last which is ovate and twice as long as thick, only a little longer than thick. Scutellum finely rugose, the cup rounded, with no fovea posteriorly and connected anteriorly with the mesonotum by a carina, the basal fovea crenated. Wings hyaline, ciliate, the veins yellowish, the marginal cell closed, the second abscissa of radius 1½ times as long as the first. Abdomen about as long as the head and thorax united, the pubescent girdle at base very faint.

Mount Gay Estate. Described from one female specimen.

(19) Hexaplasta pleuralis, sp. n.

♀. Length 1·25 to 1·5 mm. Polished black; sides of thorax brownish piceous or rufous, the metapleura red; antennæ, except the last five joints, and legs brownish yellow.

Antennæ 13-jointed, the funiclar joints 2–5 three or more times longer than thick; club-joints twice as long as thick. Cup large, oval, with a fovea posteriorly and 4 punctures anteriorly. Wings hyaline, ciliate; the veins brownish yellow, the marginal cell closed, the second abscissa of radius about 1½ times as long as the first.

Chantilly (windward side).

Resembles *H. instabilis*, but with the scutellar cup larger and the antennæ longer.

(20) Hexaplasta proxima, sp. n.

♀. Length 1·25 to 1·5 mm. Polished black; antennæ, except club, and legs brownish yellow.

Antennæ 13-jointed, extending to middle of abdomen, joints 2–5 of funicle twice as long as thick; club-joints, except the last which is ovate and larger than the others, nearly 1½ times as long as thick. Cup of scutellum oval, with a transverse fovea posteriorly and 4 punctures anteriorly. Metapleura always black. Wings hyaline, ciliate; the veins pale yellowish, the marginal cell closed, the second abscissa of radius a little longer than the first. Abdomen black, as long as the head and thorax united, with a whitish girdle at base.

♂. Length 1·25 mm. Differs from female in having long, 15-jointed, black antennæ, the first joint of flagellum one-half longer than the second, the third and following joints being about four times as long as thick.

St. John's River, St. George's, Mount Gay Estate (leeward side); Balthazar, Grand Étang, and Chantilly (windward side). Described from one male and ten female specimens.

(21) Hexaplasta dubiosa, sp. n.

♀. Length 1·6 mm. Polished black; antennæ, except sometimes the funicle which is more or less piceous, black; legs, brownish yellow.

Antennæ 13-jointed, extending almost to the middle of the abdomen; joints 2–5 of funicle subequal, hardly 1½ times as long as thick; club-joints, except the last which is ovate and twice as long as thick, only a little longer than thick. Cup of scutellum oval, with a small fovea posteriorly and 4 punctures anteriorly. Metapleura bounded by a carina behind. Wings hyaline, ciliate; the veins light brown, the marginal cell closed, the second abscissa of radius very little longer than the first, straight, the first slightly curved. Abdomen nearly as long as the head and thorax united, with a dense dusky girdle of wool at base.

Mount Gay Estate (leeward side) and Grand Étang. Described from three female specimens.

Pentamerocera, Ashm., g. n.
(Type, *P. angularis.*)

Antennæ in female 13-jointed, shorter than the body and ending in an abrupt 5-jointed club. Scutellum finely rugose or punctate;

the cup oval or ovate, rarely small, elliptic, and usually with a fovea posteriorly and some punctures anteriorly. Front wings either with an open or closed marginal cell, the first abscissa shorter than the second, the cubitus wanting; apex of wings usually entire, rarely emarginate or sinuate. Abdomen with the usual hair-fringe at base.

In having a 5-jointed antennal club this genus agrees with *Pentacrita*, Förster, a subgenus of *Kleidotoma*, but it is readily distinguished from it by the finely rugose or punctate scutellum, the cup being larger and the abdomen shorter, besides a difference in venation.

From *Cothanaspis*, which also has a 5-jointed club, it is readily separated by a raised pubescent or woolly girdle at base.

The genus is in reality a subgenus of *Eucoela*, Westwood.

The species described under the new genus may be tabulated as follows:—

Table of Species.

Females.

Marginal cell more or less open along the fore margin. 4.
Marginal cell closed.
  Apex of front wings more or less emarginate ...... 3.
  Apex of front wings entire.
    First abscissa of radius normal, not angulated... 2.
    First abscissa of radius angulated within a little beyond the middle.................................. *P .angularis*, sp. n.
2. Hind coxæ and all femora more or less toward base piceous, rest of legs brownish yellow.
  Cup of scutellum ovate, with a small fovea posteriorly and 4 punctures anteriorly .... *P. distinguenda*, sp. n.
All coxæ and legs reddish or brownish yellow.
  Antennæ black or brown-black.
    Cup of scutellum moderately large, oval, a small fovea posteriorly; mesopleura and metathorax brownish or rufo-piceous .... *P. erythropleura*, sp. n.
  Antennæ, except the club or some of the club-joints, yellow or reddish yellow.
    Cup of scutellum oval, with a small fovea posteriorly and 6 punctures on the anterior part; sides of thorax black; funiclar joints long, obconic .... *P. 6-punctata*, sp. n.
    Cup of scutellum narrowed, ovate; sides of thorax brownish; funiclar joints short, submoniliform...... .... *P. lateralis*, sp. n.
3. Legs, including coxæ, brownish yellow.
  Cup of scutellum oval, the disk subconvex, smooth, impunctate; antennæ brown-black, the joints of funicle long .... *P. connectans*, sp. n.
4. Legs entirely brownish yellow.
  Cup of scutellum very small, elliptic; joints of funicle after the first small, moniliform......... *P. nanella*, sp. n.

(1) PENTAMEROCERA ANGULARIS, sp. n.

♀. Length 1·6 mm. Polished black; antennæ dark rufous; legs reddish.

Antennæ 13-jointed, the scape twice as long as the pedicel, obconic; funicle 6-jointed, joints 2–6 subequal, a little longer than thick; club 5-jointed, the joints nearly equal, a little longer than thick. Scutellum rugose; the cup ovate, with a shallow fovea posteriorly and 4 small punctures anteriorly. Wings hyaline, ciliate; the veins pale yellowish, the marginal cell closed, the first branch of radius a little shorter than the second and angulated within a little beyond its middle. Abdomen as long as the head and thorax united, with a pubescent girdle at base.

Balthazar (windward side). Described from two female specimens. Remarkable for, and readily recognized by, the angulated first branch of the radius.

(2) PENTAMEROCERA DISTINGUENDA, sp. n.

♀. Length 1·5 mm. Polished black; antennæ dark rufous; legs brownish yellow, the hind coxæ and all the femora toward base more or less piceous or obfuscated.

Antennæ 13-jointed; funicle 6-jointed, joints 2–6 submoniliform, very little longer than thick; club 5-jointed, rounded, the last conic and a little the longest joint. Scutellum rugulose, opaque; the cup small, ovate, shining, with a minute fovea posteriorly and 4 punctures anteriorly. Wings hyaline, ciliate; the veins yellowish, the marginal cell closed, the second abscissa of radius about one-third longer than the first, the latter very slightly curved but not angulated. Abdomen at base with a sparsely pubescent girdle.

Balthazar (windward side), and St. John's River (leeward side). Described from two female specimens.

(3) PENTAMEROCERA ERYTHROPLEURA, sp. n.

♀. Length 1·25 mm. Polished black; the mesopleura and metathorax rufous or brownish piceous; antennæ black, as long as the body; legs brownish yellow.

Antennæ 13-jointed, long; funicle 6-jointed, joints 2–6 subequal in length, but the last two slightly stouter than the others, joint 1 is a little more than three times as long as thick at apex, joints 2–4 are 3 times as long as thick, while joints 5 and 6 are from 2 to 2½ times as long as thick; club 5-jointed, the joints from 2 to 2½ times as long as thick. Scutellum finely rugose; the cup rather large, oval, with a small fovea posteriorly and 4 punctures anteriorly. Wings hyaline, ciliate; the veins pale, the marginal cell closed, the second abscissa of radius about one-third longer than the first, straight, the first a little curved. Abdomen black, but brownish or piceous at base.

Balthazar (windward side). Described from two female specimens.

(4) PENTAMEROCERA 6-PUNCTATA, sp. n.

♀. Length 1·25 mm. Polished black; antennæ, except the scape and the last four joints, and legs brownish yellow.

Antennæ 13-jointed, two-thirds the length of body; funicle

6-jointed, joints 2–6 obconic, subequal, a little more than twice as long as thick at apex; club 5-jointed, the joints oblong. Scutellum finely rugose, the cup oval, with 6 punctures. Wings hyaline, ciliate; the marginal cell closed, the second branch of the radius about one-half longer than the first, straight, the first slightly curved.

Mount Gay Estate (leeward side). Described from one female specimen.

(5) PENTAMEROCERA LATERALIS, sp. n.

♀. Length 1 mm. Polished black, the sides of thorax, metathorax, and abdomen at base brownish or testaceous; antennæ and legs brownish yellow, the three or four apical joints of club dusky.

Antennæ 13-jointed, two-thirds the length of body; funicle 6-jointed, joints 2–6 submoniliform, not or scarcely longer than thick; club 5-jointed, the first joint the smallest, the second rounded, the third and fourth a little longer than thick, the last ovate. Cup of scutellum rather small, narrowed ovate, with a small indentation posteriorly, the rim testaceous, the anterior portion so small that the punctures are confluent. Wings hyaline, ciliate, the veins testaceous; otherwise as in previous species.

Balthazar (windward side). Described from one specimen.

(6) PENTAMEROCERA CONNECTANS, sp. n.

♀. Length 1 mm. Polished black; antennæ brown-black; legs brownish yellow.

Antennæ 13-jointed, nearly as long as the body; funicle 6-jointed, joints 2–6 nearly three times as long as thick; club 5-jointed, twice as long as thick, the last ovate, a little longer than the others. Cup of scutellum rather small, oval, with a delicate frenum; the disk subconvex, smooth, polished, impunctate. Wings hyaline, ciliate, the apex of front wings slightly emarginate or sinuate; the veins testaceous, the marginal cell closed, the second abscissa of radius straight, about one-third longer than the first, the latter slightly curved.

Balthazar (windward side). Described from one female specimen.

(7) PENTAMEROCERA NANELLA, sp. n.

♀. Length 0·8 mm. Polished black; antennæ, except the club, rufous; legs brownish yellow.

Antennæ 13-jointed, extending a little beyond the base of abdomen; funicle 6-jointed, joints 2–6 small, moniliform; club 5-jointed, joints 2–3 moniliform, joint 4 a little longer than thick, the last ovate. Cup of scutellum small, elliptic, with 3 small punctures. Wings hyaline, ciliate; the veins brownish, the marginal cell open along the fore border and about as wide as long, the second abscissa of radius being scarcely longer than the first, straight and stout. Metapleura covered with a griseous pubescence.

Balthazar (windward side).

TETRAMEROCERA, Ashm., g. n.
(Type, *T. variabilis.*)

Antennæ in female 13-jointed, nearly as long as the body and terminating in an abrupt 4-jointed club; otherwise similar to *Pentamerocera*: the marginal cell closed, the second abscissa of radius longer than the first with a slight outward curve, the first abscissa with a slight inward curve.

This genus is also only a subgenus of *Eucoela* and is quite distinct from *Tetrarhapta*, Förster, with which it agrees only in having a 4-jointed antennal club, the shape of the abdomen, scutellum, and venation being quite distinct.

(1) TETRAMEROCERA VARIABILIS, sp. n.

♀. Length 0·9 to 1·4 mm. Polished black, with sometimes the pleura, metathorax, and base of abdomen reddish or brownish; antennæ, except the last 2 or 3 joints, and legs brownish yellow; last 2 or 3 club-joints black.

Antennæ 13-jointed, not quite so long as the body; scape and pedicel subequal; funicle 7-jointed, the first joint the longest, 3½ times as long as thick at apex, joints 2–5 a little shorter, joints 6–7 still shorter and thicker, about twice as long as thick; club 4-jointed, the first joint a little smaller than the second, the last the stoutest. Scutellum closely punctate, the cup ovate, with a small fovea posteriorly and 4 punctures on the smooth anterior part. Wings hyaline, the tegulæ piceous; the veins light brown or yellowish, the marginal cell completely closed, the first abscissa of radius very little shorter than the second, slightly curved inwardly, the second abscissa slightly curved inwardly. Abdomen as long as the head and thorax united, black, more or less piceous or brownish toward base, and with a narrow pubescent girdle.

Balthazar (windward side) and Mount Gay Estate. Described from four female specimens.

Family ICHNEUMONIDÆ.

Subfamily OPHIONINÆ.

CHAROPS, Holmgren.

CHAROPS BIMACULATA, sp. n.

♀. Length 6 mm. Black, coarsely punctate, and more or less distinctly clothed with a glittering pubescence, especially on face, mesosternum, and metathorax; flagellum brown-black; scape, pedicel, mandibles, palpi, tegulæ, foveæ on second abdominal segment, a band at base of third segment, and legs yellow; middle and hind coxæ and femora, except tips of the middle pair, tips of middle tibiæ and base and apex of hind tibiæ and their tarsi, except narrowly at base of joints, black; tips of joints of anterior and middle tarsi dusky. Wings fuscous, the costal vein at base yellow, the stigma and all other veins black or blackish fuscous. Metathorax rugose.

Mount Gay Estate. Described from one female specimen.

EIPHOSOMA, Cresson.

EIPHOSOMA ANNULATUS, Cr.

This species is represented by 4 male and 6 female specimens taken on Mount Gay Estate.

ANGITIA, Holmgren.

ANGITIA INSULARIS, Ashm.

Cremastus? insularis, Ashm. Journ. Linn. Soc., Zool. xxv. p. 140.

This species, doubtfully described under the genus *Cremastus*, is represented by one male and one female specimen, labelled St. John's River.

THERSILOCHUS, Holmgren.

THERSILOCHUS OCULATUS, sp. n.

♂. Length 3 mm. Head and thorax above black, shining, sericeous, impunctate; metathorax areolated; thorax at sides and beneath rufous; clypeus, legs, including all coxæ, and the abdomen reddish yellow or dark honey-yellow.

Head transverse, the occiput subconvex, the frons impressed; eyes very large, occupying the whole side of the head, strongly facetted and convergent above, the vertex therefore very narrow; ocelli large, prominent, rather close together, the lateral being close to the eye-margin; clypeus not separated, prominent, and somewhat rounded anteriorly. Antennæ 17-jointed, short, not longer than the thorax, the scape and pedicel yellow; flagellum dark brown, the first joint the longest, about three times as long as thick at apex, the following joints very gradually shortening. Thorax smooth, without parapsidal furrows, the mesonotum as wide as long, the scutellum with a transverse furrow at base; metathorax posteriorly obliquely truncate, the truncature impressed medially and bounded by carinæ at the sides. Wings subhyaline, the stigma very large, triangular, and, as well as the venation, brown. Abdomen compressed, with the petiole very long and slender, about as long as the hind femora, slightly dusky towards base; body of abdomen about twice as long as the petiole, the first three segments subequal.

Mount Gay Estate. Described from one male specimen.

Subfamily TRYPHONINÆ.

ORTHOCENTRUS, Grav.

ORTHOCENTRUS VARIABILIS, Ashm. Journ. Linn. Soc., Zool. xxv. p. 141.

Mount Gay Estate. One female specimen.

Subfamily CRYPTINÆ.

MESOSTENUS, Grav.

MESOSTENUS INSULARIS, Ashm. Journ. Linn. Soc., Zool. xxv. p. 138.

Balthazar. One female specimen.

HEMITELES, Gravenhorst.

HEMITELES MACULITHORAX, sp. n.

♂. Length 2·2 mm. Polished black, impunctate, except some fine transverse lines on the middle lobe of mesonotum; mesonotum piceous, with the parapsidal furrows distinct anteriorly, the furrows anteriorly, the margins of the lateral lobes, and a large spot on the middle lobe posteriorly before the scutellum reddish yellow; tegulæ yellowish white; hind coxæ and first and last abdominal segments black, second abdominal segment yellow, third, fourth, and fifth piceous.

Antennæ 19-jointed, as long as the body, brownish yellow, but with the three basal joints yellow; first joint of flagellum the longest, the following to the last gradually becoming shorter, the last conical, about twice as long as the penultimate. Metathorax smooth, but distinctly areolated. Wings hyaline, with the venation pale yellowish; legs brownish yellow, the hind femora dusky at the middle, the hind tibiæ with a small spot beyond the base and its apex, dusky.

Mount Gay Estate. Described from one male specimen.

DIAGLYPTA, Förster.

DIAGLYPTA RADIATA, sp. n.

♀. Length 7 mm.; ovipositor one-third the length of abdomen. Head and thorax black, shining, sparsely covered with a glittering white pubescence; tegulæ and palpi yellowish white; two basal joints of antennæ, legs, and abdomen rufous. Wings hyaline, the anterior pair with a transverse brown band beyond the basal third and another broader band across the disk, enclosing the stigma and most of the radial cell, leaving only the apical fifth of the wings clear; hind wings with the apical one-fourth brown.

Head transverse, much wider than the thorax, with large prominent eyes, which occupy the whole side of the head, slightly convergent above and making the head appear convex before and behind; head before punctate, clothed with a glittering white pubescence, behind smooth, polished; antennæ 28-jointed, serrated at tips, the flagellar joints 3 and 4 longer than the first. Thorax with distinct parapsidal furrows, the lobes with transverse raised lines along the furrows; the middle lobe anteriorly nearly smooth, very finely punctate, but posteriorly just in front of the scutellum there are nine radiating raised lines; disks of lateral lobes smooth, the lateral ridges of thorax extend as carinæ along the sides of the scutellum clear to its tip, the disk of scutellum convex, smooth, at the base is a deep transverse furrow, crenated at bottom; pleura closely punctate; metathorax rugose, areolated, the large lateral areas at base strongly, transversely striated, the superior median area large, narrowed pentagonal in outline, but confluent with the petiolar area. Abdomen smooth, impunctate, the petiole broadly widened at apex, about one and two-third times the length of the second segment, the third slightly shorter than the second, the following much shorter; venter with a longitudinal fold.

Caliveny Estate. Described from two female specimens.

Subfamily PIMPLINÆ.

LABENA, Cresson.

LABENA TRILINEATA, sp. n.

♂. Length 9 mm. Yellow, smooth, impunctate; a transverse band on occiput, bases of hind ocelli, tips of mandibles, three lines on mesonotum (the lateral abbreviated anteriorly), the depression at base of scutellum, a band at base of metathorax and its extreme apex, the sutures between the prothorax and the mesopleura and between the latter and the metapleura, the coxal attachment of hind legs, a streak on hind tibiæ towards apex and their tarsi, and broad bands on the abdominal segments, all black. Wings hyaline, with dusky at tips, the stigma and venation black.

St. George's. Described from one male specimen.

This lovely species comes nearest to *L. gloriosa*, Cr., described from Mexico.

Family BRACONIDÆ.

Subfamily BRACONINÆ.

IPHIAULAX, Förster.

(1) IPHIAULAX XANTHOSPILUS, Ashm.

Bracon xanthospilus, Ashm. Journ. Linn. Soc., Zool. xxv. p. 110.

Balthazar and St. John's River. One male and two female specimens.

(2) IPHIAULAX FLAVOMACULATUS, Ashm.

Bracon flavomaculatus, l. c. p. 111.

Balthazar. Two female specimens.

BRACON, Fabr.

(1) BRACON FEMORATUS, Ashm. l. c. p. 112.

St. George's. One male specimen.

(2) BRACON PLATYGASTER, sp. n.

♀. Length 3 mm.; ovipositor short, black, one-fourth the length of abdomen. Head and thorax polished black; mandibles, legs, except tarsi which are fuscous, and abdomen, except shield of first segment and a triangular spot at base of second, rufous; shield and spot at base of second segment black. Head transverse; thorax trilobed, the metanotum punctulate, with a median carina; wings subhyaline, the stigma and venation brown-black; abdomen very broad, much wider than the thorax, the first and second segments, and a part of the third, shagreened, the rest polished, impunctate.

♂. Length 2 mm. Differs from female only in having a longer, much narrower abdomen, and in that the surface of the metathorax is smoother although carinated.

Balthazar and Mount Gay Estate. Described from one male and one female specimen.

(3) BRACON VULGARIS, Ashm. l. c. p. 112.

Grenada. Three male specimens.

(4) BRACON, sp.

Balthazar and Mount Gay Estate. Two specimens in poor condition and unfit for describing.

(5) BRACON SANCTI-VINCENTI, Ashm. l. c. p. 112.

Grenada. One male specimen without a head.

Subfamily RHYSSALINÆ.

COLASTES, Haliday.

COLASTES GRENADENSIS, sp. n.

♀. Length 2·5 mm. Brownish yellow; vertex and dorsum of abdomen with a slight brownish tinge; legs paler; wings hyaline, the stigma and venation yellowish.

Head smooth, polished, the eyes large, slightly emarginated within opposite the base of antennæ; mesonotum alutaceous; the metanotum smooth, not areolated, with a slight median carina. Wings ample, the second abscissa of radius only a little longer than the first, the second submarginal cell therefore small, nearly twice as long along the cubitus as along the radius, the recurrent nervure joining the first submarginal cell at about two-thirds its length. Abdomen about as long as the head and thorax united, shining, the surface of the dorsum a little wrinkled but not sculptured, the first and second segments subequal and the longest segments, the following gradually shortening; ovipositor not quite so long as the abdomen.

Mount Gay Estate. Described from one female specimen.

Subfamily SPATHIINÆ.

SPATHIUS, Nees.

SPATHIUS FLAVOTESTACEUS, sp. n.

♂. Length 2·5 mm. Uniformly pale brownish yellow, the eyes violaceous.

Head quadrate, the vertex and occiput finely transversely striated; antennæ 25-jointed, one and a half times as long as the body. Thorax finely shagreened, the mesopleura with a crenate furrow, the metathorax rugose, exareolated; anterior and middle coxæ and trochanters whitish; anterior wings subhyaline, with a whitish transverse band between the stigma and the basal nervure, the stigma, except at base, and nervures brown; the second abscissa of radius is one-half longer than the first. Abdomen clavate, with a very long slender petiole which is as long as the body of abdomen, with the spiracles placed at its basal third; body of abdomen ovate, polished.

Mount Gay Estate. One male specimen.

Subfamily HECABOLINÆ.

HETEROSPILUS, Haliday.

(1) HETEROSPILUS FASCIATUS, Ashm. l. c. supra, p. 118.

Mount Maitland and Grand Étang. Two male specimens.

(2) HETEROSPILUS HUMERALIS, Ashm. l. c. p. 121.

Chantilly Estate, Balthazar, St. George's, and St. John's River. Four specimens, 1 ♀, 3 ♂.

(3) HETEROSPILUS PALLIDIPES, Ashm. l. c. p. 119.

Balthazar. One female specimen, agreeing fairly well with the type except that the ovipositor is a little shorter.

Subfamily HORMIINÆ.

HORMIUS, Nees.

(1) HORMIUS RUGOSICOLLIS, sp. n.

♀. Length 2·5 mm. Polished black; collar, metathorax, and plate on first abdominal segment rugose; disk of abdomen, flagellum, and legs rufous; hind femora toward apex, coxæ, and trochanters yellowish; palpi whitish.

Antennæ 21-jointed, the scape black, the flagellum dusky towards apex; mesonotum smooth, polished, trilobed; the scutellum bifoveated at base, the foveæ with some raised lines at bottom; mesopleura with a deep fovea below the middle. Wings hyaline, pubescent, the stigma whitish, the nervures tinged with brown, the second abscissa of radius about one-half longer than the first, the recurrent nervure joining an angle in the second submarginal cell. Abdomen long-oval, about as long as the head and thorax united, the lateral margins of the first segment and a large spot on dorsum of second and third segments rufous, rest of abdomen black; the plate of the first segment is rugose, the following segments smooth and shining but slightly wrinkled; ovipositor short, stout.

Mount Gay Estate. Two female specimens.

(2) HORMIUS MELLEUS, Ashm.

Grand Étang and Mount Gay Estate. Two female specimens.

Subfamily RHOGADINÆ.

RHOGAS, Nees.

RHOGAS BIFASCIATUS, sp. n.

♀. Length 5 mm. Brownish yellow; eyes, stemmaticum, and last joint of tarsi black; abdominal segments 1, 2, and 3 longitudinally striated, the first with a median carina.

Antennæ 40-jointed, the basal third of the flagellum black. Wings hyaline, bifasciated; the first fascia is situated at the base of the basal nervure and encloses the transverse median nervure; the second extends across the wing from the middle of the stigma; all nervures, except the portions enclosed by the fasciæ, are brownish yellow, the portions enclosed by the fasciæ being black; there is also a black spot at base of costal and anal nervures.

♂. Length 4 mm. Agrees with the female, except the antennæ are 34-jointed, wholly brownish yellow, or then with only two or three basal joints of flagellum black.

St. George's and Mount Gay Estate. Described from eight male and four female specimens.

Subfamily CHELONINÆ.

PHANEROTOMA, Wesmael.

(1) PHANEROTOMA INSULARIS, Ashm. l. c. p. 124.

St. George's and Mount Gay Estate. Six specimens.

(2) PHANEROTOMA HUMERALIS, Ashm. l. c. p. 125.

Mount Gay Estate. One specimen.

Subfamily AGATHIDINÆ.

AGATHIS, Latreille.

(1) AGATHIS RUBRICINCTUS, Ashm. l. c. p. 128.

Balthazar, St. George's, and St. John's River. Three female specimens. This species also occurs in Jamaica.

(2) AGATHIS PECTORALIS, Ashm. l. c. p. 129.

Balthazar, St. George's. Three male specimens.

MICRODUS, Nees.

(1) MICRODUS STIGMATUS, Cr.

Balthazar, St. George's, Mount Gay Estate, and Vendôme Estate. Four male and two female specimens.

(2) MICRODUS VARIPES, Cr.

Mount Gay Estate and St. George's. Seven male and two female specimens.

(3) MICRODUS INSULARIS, Ashm. l. c. p. 130.

Mount Gay Estate. One female specimen.

(4) MICRODUS UNICINCTUS, Ashm. l. c. p. 129.

St. George's. One female specimen.

Subfamily TOXONEURINÆ.

TOXONEURA, Say.

TOXONEURA ATRICORNIS, Ashm. l. c. p. 132.

Mount Gay Estate and St. George's. Seven male and four female specimens.

Subfamily MACROCENTRINÆ.

MACROCENTRUS, Curtis.

MACROCENTRUS DELICATUS, Cr.

St. John's River. This species is represented by a single female specimen, which agrees very well with some of the forms collected in Texas, except that the lobes of mesonotum, as well as the dorsum of abdomen, are more distinctly black.

Subfamily OPIINÆ.

OPIUS, Wesmael.

(1) OPIUS UNIFASCIATUS, Ashm. l. c. p. 135.

Grand Étang. Two male specimens.

(2) OPIUS REJECTUS, Ashm. l. c. p. 136.

Mount Gay Estate. One male specimen.

(3) OPIUS INTERSTITIALIS, Ashm.

Balthazar. Two male specimens.

(4) OPIUS SALVINI, Ashm.

Mount Gay Estate. One male specimen.

Subfamily ALYSIINÆ.

SYNCRASIS, Förster.

SYNCRASIS FLAVIFRONS, sp. n.

♂. Length 1·5 mm. Polished black; head, except vertex, trophi, first three joints of antennæ, tegulæ, legs, including coxæ, and the basal half of the abdomen brownish yellow.

Antennæ 25-jointed, longer than the body, the fifth joint longer than the fourth. Mesonotum trilobed, the middle lobe extending only to half the length of the mesonotum, a fovea or grooved line between its apex and the scutellum; metanotum with a transverse carina before its apex. Wings hyaline, the stigma and venation brown; the radius originates beyond the middle of the stigma, its first branch short, only one-third the length of the radius; first submarginal and first discoidal cells confluent. Abdomen as long as head and thorax united, with the first segment striated, the following segments smooth, polished.

Mount Gay Estate. One male specimen.

APHAERETA, Förster.

APHAERETA APICALIS, sp. n.

♀. Length 1·8 mm. Polished black; mandibles, palpi, first four joints of antennæ, tegulæ, legs, and basal abdominal segment brownish yellow or pale yellow; last six joints of antennæ white. Wings hyaline, the venation light brown. Mesonotum without furrows, while the metanotum has a median carina connected by a carina bounding the posterior margin. Abdomen, except the basal segment which is striate, smooth and polished; the ovipositor as long as the abdomen, black and hairy.

Mount Gay Estate. Described from one female specimen, and readily distinguished from all other species by the white apical joints of antennæ.

Family PROCTOTRYPIDÆ.

Subfamily BETHYLINÆ.

DISSOMPHALUS, Ashm.

(1) DISSOMPHALUS TUBERCULATUS, Ashm. Journ. Linn. Soc., Zool. xxv. p. 193.

Chantilly Estate. One male specimen.

(2) DISSOMPHALUS BISULCUS, Ashm. l. c. p. 194.

Mount Gay Estate. Four male specimens.

(3) DISSOMPHALUS CONFUSUS, Ashm. l. c. p. 194.

Balthazar. Two male specimens.

.. EPYRIS, Westw.

EPYRIS PYGMÆUS, sp. n.

♂. Length 1·5 mm. Black, subopaque, finely coriaceous; legs piceous; trochanters, tibiæ, and tarsi brownish yellow; wings subhyaline, pubescent, the venation brown; tegulæ brownish yellow.

Antennæ 13-jointed, as long as the body, black, pubescent; pedicel and first flagellar joint equal in length, two-thirds the length of the second, the joints beyond the second as far as to the penultimate imperceptibly shortening, the last joint longer, as long as the second. Pronotum long, trapezoidal; mesonotum short, transverse, with two delicately grooved lines anteriorly; mesopleura convex, with a fovea above the middle; metanotum longer than wide, quadrate. Abdomen oblong-oval, polished, depressed, the petiole longer than thick, grooved above.

Mount Gay Estate. Described from one male specimen.

GONIOZUS, Förster.

(1) **GONIOZUS NIGRIFEMUR**, Ashm. l. c. p. 195.

St. George's. One female specimen, which is a little smaller than the type.

(2) **GONIOZUS INCOMPLETUS**, Ashm. l. c. p. 196.

Mount Gay Estate. One female specimen.

Subfamily DRYININÆ.

APHELOPUS, Dalman.

APHELOPUS ALBOPICTUS, Ashm. Monogr. N. A. Proct. p. 101.

Balthazar and St. John's River. Three male specimens.

Subfamily CERAPHRONINÆ.

Tribe CERAPHRONINI.

CERAPHRON, Jurine.

Table of Species.

Black; legs and antennæ, except sometimes the flagellum, brownish yellow.
  Head and thorax smooth, shining .... 2.
  Head and thorax opaque or subopaque, punctate.
    Head and thorax opaque, closely minutely punctulate; flagellum brown-black, subclavate, the pedicel one-third longer than the first flagellar joint, the following joints gradually increasing in size, quadrate, the last ovate, large .... *C. grenadensis.*
    Head and thorax subopaque, sparsely punctate; flagellum brown-black, subclavate, the pedicel as long as the first and second flagellar joints united, joints 2 to 5 a little wider than long, 6–7 longer than wide, the last ovate .... *C. subopacus.*

2. Abdomen brownish yellow at base and beneath .... 3.
 Abdomen entirely black; flagellum subclavate, the last four or five joints only black
  Face transversely wrinkled; flagellar joints 2 to 4 transverse, a little wider than long, joints 5 to 7 quadrate, the last oblong, twice as long as the preceding .... *C. rugifrons.*
  Face smooth, polished; flagellar joint as long as the pedicel, joints 2–3 about half as long as the first, 4 quadrate, 5 to 7 longer than wide, the last ovate, half longer than the 7th .... *C. politifrons.*
3. Legs and basal joints of antennæ yellowish .... *C. basalis*, Ashm.

(1) CERAPHRON GRENADENSIS, sp. n.

♀. Length 1 mm. Black, opaque, minutely, closely punctate; scape, pedicel, and legs brownish yellow; flagellum brown-black; wings hyaline, pubescent, the venation dark brown.

Head transverse, the face concave, shining; frons, vertex, and cheeks closely punctulate, opaque; flagellum subclavate, about twice as long as the scape, the pedicel one-third longer than the first flagellar joint, second and following flagellar joints to last gradually increasing in size, quadrate, the last ovate, about twice as long as the penultimate. Thorax above opaque, closely minutely punctate, sericeous; pleura smooth, shining; tegulæ brownish piceous; metanotum armed with a small thorn. Abdomen sessile, ovate, polished black, pointed at tip, as long as the head and thorax united, and with some striæ at base above.

Balthazar. Described from one female specimen.

(2) CERAPHRON SUBOPACUS, sp. n.

♀. Length 1 mm. Black, subopaque, sparsely punctate, the punctures not so dense as in the preceding species and the surface with a slight lustre, the scutellum shining; scape and legs yellow, the hind coxæ dusky or black; wings hyaline, pubescent, the venation light brown.

Head transverse, the face emarginate, shining; flagellum dark brown or blackish, not twice as long as the scape, the pedicel as long as the first and second flagellar joints united; flagellar joints 2 to 5 a little wider than long, 6 and 7 longer than wide, the last ovate, not quite twice as long as the penultimate. Thorax above subopaque, the scutellum shining; pleura smooth, shining; metanotum with a small tubercle. Abdomen sessile, as long as the head and thorax united, polished black.

Balthazar. Described from one female specimen.

(3) CERAPHRON RUGIFRONS, sp. n.

♀. Length 1 mm. Black, shining; head and thorax above smooth, impunctate; face and frons with delicate, transverse rugæ; antennæ, except last four joints, and legs, including all coxæ, brownish yellow; wings hyaline, pubescent, the venation brownish yellow. Flagellum, excluding the pedicel, 1½ times as long as the scape, joints 2–4 transverse, a little wider than long, 5–7 quadrate, the last oblong, twice as long as the preceding.

Abdomen as long as the head and thorax united, polished black, striated at base above.

Balthazar. Described from one female specimen.

(4) CERAPHRON POLITIFRONS, sp. n.

♀. Length 1·2 mm. Polished black, impunctate, the frons and face perfectly smooth, shining; antennæ, except the last four or five joints, and legs brownish yellow or yellow, the hind coxæ dusky basally; wings hyaline, pubescent, the venation light brown. Flagellum subclavate, the first joint as long as the pedicel, joints 2 and 3 about half as long as the first, a little longer than thick, joint 4 quadrate, joints 5–7 longer than wide, gradually increasing in length, joint 8, or the last, ovate, one-half longer than the penultimate.

Balthazar and St. George's. Described from two female specimens.

(5) CERAPHRON BASALIS, Ashm. Monogr. N. A. Proct. p. 127.

Mount Gay Estate. A single female specimen.

APHANOGMUS, Thomson.

Table of Species.

Polished black; scape and legs brownish yellow.

Flagellum clavate, brown, sometimes with the pedicel and one or two flagellar joints yellowish; joints 1 to 4 small, moniliform, after the first transverse; joints 5 and 6 much larger, transverse, nearly as large as the 7th, the 8th oblong .... *A. grenadensis.*

Flagellum brownish or dusky only at tips; first joint minute, obconic, the second and following joints gradually increasing in width, transverse-moniliform, the 7th and 8th much larger, the 7th transverse quadrate, the last long, large ovate .... *A. insularis.*

(1) APHANOGMUS GRENADENSIS, sp. n.

♀. Length 0·6 mm. Polished black; scape, with sometimes the pedicel and one or two joints of funicle, and legs brownish yellow; wings hyaline, ciliated, the nervures light brown. Head transverse, the face slightly impressed; eyes large, bare; antennæ much incrassated towards tips; first joint of flagellum very minute, joints 2 to 4 transverse, nearly as large as the 7th, joint 8 or the last oblong. Mesonotum with a single grooved line; scutellum convex, polished, longer than wide at base. Abdomen subsessile, ovate, a little piceous at base.

Balthazar. Described from two female specimens.

(2) APHANOGMUS INSULARIS, sp. n.

♀. Length 0·6 mm. Agrees with the previous species, except that only the tip of the flagellum is dusky or black and the joints are relatively different. The flagellar joints 2 to 5 are transverse moniliform; the 6th is much enlarged; the 8th quadrate; the 9th conic; the 8th and 9th black or dusky. Wings hyaline, pubescent, with an indistinct fascia below the parastigma. Abdomen black, slightly paler at base.

Balthazar. Described from two female specimens.

Subfamily SCELIONINÆ.

Tribe TELENOMINI.

TELENOMUS, Haliday.

Table of Species.

Females.

Pedicel distinctly longer and thicker than the first funicular joint	3.
Pedicel shorter, or at least never longer, than the first funicular joint.	
First funicular joint very little longer than the pedicel	2.
First funicular joint distinctly longer than the pedicel.	
Head 3 times as wide as thick antero-posteriorly; the head, scutellum, and abdomen polished, impunctate.	
Mesonotum opaque, strigoso-scabrous; legs and antennæ, except the last 5 joints, yellow ...	*T. grenadensis.*
Mesonotum opaque, finely rugose; legs and antennæ, except the last 9 joints, yellow ...	*T. longiclavatus.*
Mesonotum polished, at the most with sparse microscopic punctures; legs and antennæ, except the last 5 joints, yellow	*T. connectans.*
Head quadrate, not twice as wide as thick antero-posteriorly; head, scutellum, and abdomen polished, impunctate	
Mesonotum closely, microscopically punctate, shining; legs pale yellow; scape and pedicel brownish yellow	*T. luteipes.*
2. Head very wide, about 4 times as wide as thick antero-posteriorly.	
Head and abdomen polished, impunctate; mesonotum and scutellum minutely shagreened; scape, pedicel, and legs brownish yellow	*T. megacephalus.*
3. Head quadrate, less than twice as wide as thick antero-posteriorly	5.
Head transverse-quadrate, but more than twice as wide as thick antero-posteriorly, the occiput deeply concave	4.
Head transverse, from 3 to 3½ times as wide as thick antero-posteriorly.	
Mesonotum strigoso-rugose; head and scutellum smooth, polished; legs and antennæ, except club, brownish yellow................................	*T. scaber*, Ashm.
Mesonotum minutely punctate.	
Scape, pedicel, and legs yellow; second abdominal segment black	*T. latifrons.*
Antennæ, except last 5 joints, and legs yellow; second abdominal segment more or less piceous or rufous	*T. nigriclavatus.*
Mesonotum polished, impunctate.	
Abdomen black.	
Antennæ dark brown, almost black; legs brownish yellow	*T. fuscicornis.*
Antennæ brown-black; legs fuscous or black, the trochanters, knees, and tarsi whitish.	*T. albitarsis.*
Abdomen brownish yellow; scape and legs yellow, the flagellum light-brown	*T. flaviventris.*

4. Species polished, impunctate.
  Antennæ, except club, and legs brownish yellow. *T. convergens.*
5. Legs, including coxæ, yellow or brownish yellow.
  Second abdominal segment twice as long as wide at apex; mesonotum subopaque, closely punctate .... *T. confusus*, Ashm.
  Second abdominal segment not twice as long as wide at apex, only about 1½ times as long as wide.
    Mesonotum subopaque, minutely punctulate; antennæ, except scape beneath, brown-black. *T. consimilis.*
    Mesonotum smooth, polished; antennæ, except club, brownish yellow .... *T. magniclavus*, Ashm.

Males.

First and third flagellar joints short, or scarcely longer than thick, or one or the other not longer than thick .... 3.
First and third flagellar joints long, more than twice as long as thick, the second still longer.
  Head transverse-quadrate, about 2½ times as wide as thick antero-posteriorly .... 2.
  Head widely transverse, 3 to 3½ or more times longer than thick antero-posteriorly.
    Mesonotum smooth, shining, at the most with sparse, microscopic punctures, first and third flagellar joints about equal in length .... *T. connectans.*
2. Mesonotum polished.
  First and third flagellar joints subequal, the third the stouter, second joint one-half longer than the first; flagellum black; scape, pedicel, and legs brownish yellow .... *T. convergens.*
  First and third flagellar joints equal, the third the stouter, the second a little longer; flagellum brown, scape and pedicel brownish yellow, the legs luteous .... *T. luteipes.*
Mesonotum polished, impunctate.
  Head quadrate, scarcely twice as wide as thick ...... 4.
  Head transverse, 3 or more times wider than long.
    First and third flagellar joints not longer than thick, the first much the stouter, the second a little longer than thick, the joints after the third moniliform, the last conical, twice as long as the preceding; legs brownish yellow, the antennæ fuscous .... *T. fuscicornis.*
    First and second flagellar joints nearly equal in length, the third and following joints moniliform, the last conical, twice as long as the preceding; legs, scape, and pedicel brownish yellow .... *T. latifrons.*
    First flagellar joint a little longer than thick, the second and following joints moniliform; legs and flagellum light brown, scape yellowish, the tarsi whitish .... *T. albitarsis.*
4. Second flagellar joint a little longer than thick, the following joints moniliform; legs, scape, and pedicel brownish yellow, flagellum light brown ... *T. magniclavus.*

(1) TELENOMUS GRENADENSIS, sp. n.

♀. Length 1 to 1·2 mm. Black, shining; head, scutellum and abdomen polished, impunctate; mesonotum opaque, strigoso-scabrous, sericeous; first abdominal segment above and the second at the suture striated; antennæ, except last 5 joints, and the legs, including all coxæ, brownish yellow or yellow; mandibles yellow.

Head broadly transverse, fully 3 times as wide as thick antero-posteriorly, the face and frons convex, but with an impression above the insertion of antennæ and connected with the front ocellus by a median grooved line; antennæ 11-jointed, not quite so long as the body, the flagellum with the pedicel scarcely 1½ times as long as the scape; pedicel and first funicular joint lengthened, the latter a little longer, 3 times as long as thick, the second funicular joint a little shorter than the pedicel, the third transverse, moniliform, the fourth transverse, a little wider than the third and in all probability forming the first joint of the club; the following joints, or the club, black, all the joints of which, except the last which is conical, are transverse-quadrate; tegulæ rufo-piceous; wings hyaline, ciliated, the venation yellowish, the marginal vein about half the length of the stigmal; mesopleura with a smooth channel extending from beneath tegula to the middle coxæ, the ridge separating them from the metapleura bounded by a single row of punctures. Abdomen about as long as the thorax, but narrower and narrowed towards base, depressed, truncate at apex, the second segment scarcely longer than wide at apex.

Chantilly Estate, Balthazar, and Mount Gay Estate. Described from eight female specimens.

(2) TELENOMUS LONGICLAVATUS, sp. n.

♀. Length 1 mm. Black, shining; head, except some fine reticulations on the vertex, the scutellum and the abdomen polished, impunctate; mesonotum opaque, finely rugose, sericeous; first abdominal segment not striated; scape, pedicel, mandibles, and legs brownish yellow.

Head broadly transverse, a little more than 3 times as wide as thick antero-posteriorly; antennæ 11-jointed, the flagellum twice as long as scape, the first funicular joint one-third longer than pedicel, the second a little shorter but still longer than the pedicel, the third nearly twice as long as thick, the fourth as long as thick; club 5-jointed, the first joint a little longer than thick, but not quite so wide as the following, joints 2, 4 and 5 quadrate, the last oblong. Wings hyaline, pubescent, the venation pale or yellowish, the marginal vein about one-third the length of the stigmal.

Balthazar. Described from one female specimen.

Distinguished from *T. grenadensis* by the different sculpture of the mesonotum, longer flagellum, and the relative length of the joints.

(3) TELENOMUS CONNECTANS, sp. n.

♀. Length 0·8 to 1 mm. Polished black, the mesonotum faintly sericeous, at the most with only a few, sparse, microscopic punctures; antennæ, except club, mandibles, and the legs brownish yellow; first abdominal segment striated; wings hyaline, pubescent.

Head broadly transverse, 3½ times as wide as thick antero-posteriorly; antennæ 11-jointed, the flagellum about 1½ times as long as the scape; first funicular joint much longer than the pedicel, 3 times as long as thick, the second joint only a little longer than thick, third and fourth about equal, moniliform; club black or brown-black, 5-jointed, the joints, except the last, transverse-quadrate.

The male agrees with the female, except in the antennæ, which are filiform, with the last 5 joints dusky, the flagellum being about 3½ times as long as the scape; the pedicel is small, rounded, the first three flagellar joints being lengthened, the first and second about equal in length, while the second is still longer, the joints after the third being elliptical and gradually growing shorter, the last conical, twice as long as the preceding.

Balthazar, Chantilly Estate, Grand Étang, and Mount Gay Estate. Described from 25 specimens representing both sexes.

(4) TELENOMUS LUTEIPES, sp. n.

♀. Length 0·9 to 1 mm. Black, shining; head, scutellum, and abdomen polished, impunctate; mesonotum closely, minutely punctate, although still shining; scape and pedicel brownish yellow; legs luteous; the coxæ whitish; wings hyaline, pubescent.

Head quadrate, scarcely more than twice as wide as thick antero-posteriorly; antennæ 11-jointed, the first funicular joint very little longer than the pedicel, the second a little shorter, the third and fourth about equal; club 5-jointed, the first joint the narrowest, the following to last quadrate, the last conical.

The male measures only 0·8 mm. in length; the antennæ filiform, brown, as long as the body, the first and third joints of flagellum equal, but the third slightly the stouter, the second a little longer, the joints beyond third much shorter, but still all longer than thick, the last still longer.

Balthazar, Chantilly Estate, and St. John's River. Described from one male and two female specimens.

(5) TELENOMUS MEGACEPHALUS, Ashm. Journ. Linn. Soc., Zool. xxv. p. 212.

Balthazar. One female specimen.

(6) TELENOMUS SCABER, Ashm. l. c. p. 208.

Balthazar, Chantilly Estate, Mount Gay Estate, and St. George's. Six female specimens.

(7) TELENOMUS LATIFRONS, sp. n.

♀. Length 0·8 to 0·9 mm. Black, polished, the mesonotum minutely punctate; scape, pedicel, or at least beneath, and legs brownish yellow; wings hyaline, ciliated, the venation pale, the marginal vein about one-third the length of the stigmal.

Head broad, a little more than 3 times as wide as thick antero-posteriorly; antennæ 11-jointed, the flagellum, excluding pedicel, about 1½ times as long as the scape; first funicular joint scarcely longer than thick, shorter than the pedicel, second joint not longer than thick, third and fourth smaller, transverse; club 5-jointed, the joints, except the last, transverse-quadrate. Abdomen truncate at tip, the first segment and the second at the suture striated, third segment a little longer than wide at apex.

In the male the flagellum is filiform, brown, the first and second joints about equal in length, a little longer than thick, the third and following, except the last, moniliform, the last conical.

Balthazar, Mount Gay Estate, St. George's.

(8) TELENOMUS NIGRICLAVATUS, sp. n.

♀. Length 0·8 to 0·9 mm. Black, shining, the mesonotum subopaque, minutely punctate, the second abdominal segment more or less rufous or piceous above; antennæ, except the club, and the legs yellow; wings hyaline, ciliated, the venation pale yellowish, the marginal vein about one-third the length of the stigmal.

Head transverse, about 3 times as wide as thick antero-posteriorly; antennæ 11-jointed, the flagellum, with the pedicel, only about 1½ times as long as the scape; first joint of funicle about two-thirds the length of the pedicel, the second not longer than thick, the third moniliform, the fourth subquadrate, much broader than the third; club 5-jointed, the joints, except the last, transverse-quadrate, the first a little the longest, the last conical. Abdomen subtruncate at apex, the first segment transverse, striated, second segment about 1½ times as long as wide at apex.

Balthazar, Grand Étang, and Mount Gay Estate. Described from eight female specimens.

(9) TELENOMUS FUSCICORNIS, sp. n.

♀. Length 0·8 mm. Polished black, impunctate; antennæ fuscous or brownish black; legs brownish yellow; wings hyaline, ciliated, the venation light brown, the marginal vein very short.

Head transverse, a little more than 3 times as wide as thick antero-posteriorly; antennæ 11-jointed, the flagellum about 1½ times as long as the scape; first funicular joint about 1½ times as long as thick, or a little shorter than the pedicel, the second not longer than thick, the third minute, transverse, not so wide as the preceding, the fourth larger, transverse; club 5-jointed, the joints, except the last, transverse, the second and third the widest joints, the last conical. Abdomen scarcely as long as the thorax, oval, the second segment a little wider than long at apex.

♂. Length 0·7 mm. Differs from the female in having 12-jointed, filiform antennæ, which are about as long as the abdomen and tapering slightly toward apex, the first and third flagellar joints being no longer than wide, the first being the stouter, the second a little longer than wide, all the other joints, except the last, which is conical and about twice as long as the penultimate, being moniliform.

Balthazar, Grand Étang, Mount Gay Estate, and St. John's River. Described from one male and five female specimens.

(10) TELENOMUS ALBITARSIS, sp. n.

♀. Length 0·65 mm. Polished black, impunctate; antennæ black or brown-black; legs fuscous or black, with the trochanters, knees, and tarsi white or yellowish white; wings hyaline, ciliated, the venation light brown, the marginal vein about one-third the length of the stigmal.

Head transverse, about 3½ times as wide as thick antero-posteriorly; first funicular joint not longer than thick, the second a little shorter, the third and fourth minute, transverse, narrower than the preceding; club 5-jointed, with the joints, except the last, transverse, the last conic. Abdomen shorter than the thorax, with the second segment wider than long.

The male measures about 0·55 mm. long; the flagellum is filiform-moniliform, light brown, the first flagellar joint being the stoutest joint, stouter but not longer than the pedicel, all the other joints, except the last, being smaller, moniliform, while the legs are brownish.

Mount Gay Estate and St. John's River. Described from one male and five female specimens.

[(11) TELENOMUS FLAVIVENTRIS, sp. n.

♀. Length 0·6 mm. Head and thorax black, polished; scape and legs yellow; flagellum light brown; abdomen brownish yellow; wings hyaline, ciliated, the venation pale, the marginal vein scarcely one-third the length of the stigmal.

Head very wide, 3½ times as wide as thick antero-posteriorly; flagellum about 1½ times as long as the scape, the first joint scarcely longer than thick and much smaller than the pedicel, second and third joints moniliform, the third slightly the smaller joint, the fourth minute, transverse, the fifth transverse, but wider and larger than the fourth; club 4-jointed, the joints, except the last, quadrate, nearly equal in size, the last conical. Abdomen truncate at apex and not longer than wide at apex, viewed from above more or less triangular, the second segment being wider than long.

Hab. Kingston, Jamaica. Described from two female specimens in National Museum, received from T. D. A. Cockerell.]

(12) TELENOMUS CONVERGENS, sp. n.

♀. Length 0·8 mm. Polished black, impunctate; antennæ, except club, and the legs brownish yellow, rarely with the funicular joints above dusky; wings hyaline, ciliated, the venation brownish, the marginal vein not quite half the length of the stigmal.

Head transverse-quadrate, about 2½ times as wide as thick antero-posteriorly, the occiput deeply concave; first joint of funicle not longer than thick, the second, third, and fourth wider than long and gradually becoming shorter and narrower; club 5-jointed, the joints, except the last, transverse, the third the widest, the last conical. Abdomen viewed from above ovate, the second joint much longer than wide at apex.

The male agrees with the female quite closely, except the flagellum is filiform, brown-black or brown, the first and third joints almost equal, the latter the stouter, the second joint one-half longer than the first, the following joints shorter than first, elliptical, gradually shortening and becoming moniliform, the last being conical and more than twice as long as the penultimate.

Balthazar, Mount Gay Estate, and St. George's. Described from one male and eight female specimens.

(13) TELENOMUS CONFUSUS, Ashm. l. c. p. 204.

Balthazar and Mount Gay Estate. Five female specimens.

(14) TELENOMUS CONSIMILIS, sp. n.

♀. Length 0·65 mm. Black, polished, the mesonotum subopaque, minutely punctate; antennæ, except scape beneath, brown-black; legs brownish yellow; wings hyaline, ciliated, the venation light brown, the marginal vein about half the length of the stigmal.

Head quadrate, not twice as wide as thick antero-posteriorly; funiclar joints 1 and 2 about equal, not longer than thick, 3 and 4 small, moniliform; club 5-jointed, fusiform, the joints, except the last, transverse, the last conical. Abdomen ovate, as long as the thorax, the first segment and the second at extreme base striated, the second segment being about 1½ times as long as wide at apex.

Balthazar. Described from one female specimen.

(15) TELENOMUS MAGNICLAVUS, Ashm. l. c. p. 205.

Grenada. Six female specimens.

Tribe. TELEASINI.

GRYON, Haliday.

GRYON BASICINCTUS, sp. n.

♀. Length 0·9 mm. Polished black; petiole of abdomen and legs brownish yellow; antennæ black; wings hyaline.

Head transverse, 3 times as wide as thick antero-posteriorly; antennæ 12-jointed, the first and second funicular joints subequal, a little longer than the pedicel, the third and fourth very minute; club 6-jointed, the joints, except the last, transverse-quadrate, the last conic; first joint of abdomen wider than long, yellow, and finely striated; body of abdomen oval, black.

Balthazar. Described from a single female specimen, readily distinguished from all others placed in this genus by the yellow petiole and its highly polished impunctured surface.

HOPLOGRYON, Ashmead.

HOPLOGRYON PALLIPES, sp. n.

♀. Length 0·8 mm. Black, shining; scape, pedicel, legs, including coxæ, mandibles, and first abdominal segment yellow; flagellum brown-black.

Head transverse, smooth, polished, impunctate; mesonotum posteriorly and the scutellum faintly, microscopically punctate; metathorax with a piceous tinge. Wings hyaline, extending slightly beyond the apex of abdomen, the venation light brown. Abdomen, except first segment, smooth, polished; first segment yellow, striated.

Mount Gay Estate. Described from one female specimen.

Tribe SCELIONINI.

CALOTELEIA, Westwood.

(1) CALOTELEIA DORSALIS, sp. n.

♀. Length 2·2 mm. Opaque, black, the mesonotum, scape, pedicel, legs, petiole of abdomen beneath, and the base of the third ventral segment brownish yellow.

Head transverse, twice as wide as thick antero-posteriorly, closely punctate; eyes sparsely pubescent; antennæ 12-jointed, clavate, the scape about as long as the pedicel and funicle united; first funicular joint about as long as the pedicel; joints 2 to 4 moniliform, the fourth a little transverse and a little smaller than the third; club large, fusiform, 6-jointed. Thorax without furrows, closely punctate, the metathorax with acute lateral tubercles; wings hyaline, iridescent, not extending quite to the tip of the abdomen, the venation light brown. Abdomen fusiform, about one and a half times as long as the head and thorax united, smooth and polished, except the petiole, which is striated; the horn at base is quite short.

Balthazar. Described from one female specimen.

(2) CALOTELEIA STRIATIFRONS, sp. n.

♀. Length 3 mm. Black, shining; collar piceous; scape and legs brownish yellow.

Head on vertex and the frons coarsely, longitudinally striated, the occiput transversely striated; flagellum twice as long as the scape, the first joint $\frac{1}{3}$ longer than the pedicel, the second joint twice as long as thick, fourth and fifth not longer than thick; club subfusifrom, 6-jointed, the joints, except the last, transverse-quadrate. Thorax with distinct parapsidal furrows, the surface anteriorly sparsely punctate and faintly shagreened posteriorly, while the scutellum is smooth, impunctate. Wings hyaline, iridescent, the venation brown. Abdomen long, fusiform, nearly twice as long as the head and thorax united, except the first two segments, which are striated, smooth, and polished; horn at base very prominent, polished.

Balthazar. Described from one female specimen.

(3) CALOTELEIA GRENADENSIS, sp. n.

♀. Length 2·5 mm. Black and shining, except the head which is opaque, closely punctate; the scape, pedicel, mandibles, collar, legs, and apex of first abdominal segment, including the base of the second, brownish yellow. The flagellum is about one and a half times as long as the scape, the first joint very little longer than the pedicel, second and third quadrate, fourth very minute; club fusiform, 6-jointed. Thorax sparsely punctate, with distinct parapsidal furrows; wings hyaline, the venation brown. Abdomen fusiform, 1½ times as long as the head and thorax together, polished, the first segment and the second at base striated; horn at base prominent, smooth.

Mount Gay Estate. Described from one female specimen.

CACUS, Riley.

CACUS INSULARIS, Ashm. l. c. p. 227.

Mount Gay Estate. One male specimen.

ANTERIS, Förster.

(1) ANTERIS RUFIPES, Ashm. l. c. p. 227.

Mount Gay Estate. Two male specimens.

(2) ANTERIS STRIATIFRONS, sp. n.

♀. Length 2 mm. Black, shining; antennæ, except club, and legs brownish yellow, the apex of scape and funicle more or less obfuscated; wings hyaline, the nervures yellowish.

Head transverse, the frons and face longitudinally striated; mandibles ferruginous; antennæ 12-jointed, the pedicel and first joint of funicle about equal in length, the second funicular joint a little longer than wide, the third quadrate, the fourth transverse; club fusiform, 6-jointed. Thorax with distinct parapsidal furrows, smooth, shining, but under a high-power lens showing some sparse microscopic punctures; mesopleura rather closely punctate; scutellum polished, impunctate. Abdomen fusiform, longer than the head and thorax united, polished, impunctate, except the first and second segments above, which are striated.

Balthazar. Described from one female specimen.

CREMASTOBÆUS, Ashmead.

CREMASTUS ANNULIPES, sp. n.

♂. Length 1·2 mm. Black, subopaque, minutely punctulate; antennæ light brown, the flagellum filiform, submoniliform, the joints, except the first and last, nearly equal, the first a little longer than the pedicel, the last ovate. Thorax convex, without parapsidal furrows; wings hyaline, the nervures light brown; legs black, tibiæ with an annulus at base and the anterior tibiæ at apex yellowish, all tarsi brownish yellow. Abdomen as long as head and thorax united, the segments constricted and striated at the sutures.

Balthazar. Described from one male specimen.

HADRONOTUS, Förster.

(1) HADRONOTUS RUGOSITHORAX, sp. n.

♀. Length 1·6 mm. Black, very coarsely, irregularly rugose, the thorax showing several raised lines before the scutellum; antennæ entirely black; legs black, the trochanters, anterior tibiæ, and base of middle and posterior tibiæ, and all tarsi brownish yellow; wings hyaline, the nervures light brown, the marginal vein scarcely half the length of the stigmal vein.

Head wider than the thorax, the facial impression bounded by a raised margin, transversely striated; mandibles black; pedicel much longer and stouter than the first funicular joint; funicular joints to club gradually broadened; club fusiform, the four middle joints much broader than long, the last conic. Thorax very coarsely, irregularly rugose; scutellum coarsely rugose. Abdomen oval, sessile, shagreened, the second segment a little the longest, the third scarcely half as long as the second, the fourth half the length of the third, the following very short; first segment and the second at base above striated; venter punctate.

St. John's River. Described from one female specimen.

(2) HADRONOTUS AGILIS, sp. n.

♀. Length 0·9 mm. Black, coarsely rugose; scape at extreme base, tibiæ, and tarsi honey-yellow.

Head wider than the thorax, the facial impression immargined; first funicular joint two-thirds the length of pedicel; second half the length of first, third and fourth transverse; club-joints, except the last, transverse. Wings hyaline, the venation light brown, the marginal vein about as long as the stigmal. Abdomen shagreened, the second segment a little longer than the first, the first striated.

Mount Gay Estate. Described from one female specimen.

(3) HADRONOTUS ATROCOXALIS, sp. n.

♀. Length 1·2 mm. Black, opaque, rugose; antennæ, except club, and legs, except coxæ and trochanters, brownish yellow; club, coxæ, and trochanters black. Wings hyaline, the venation yellowish, the marginal vein not half the length of the stigmal; pleura striated. Abdomen rugose, clothed with a glittering white pubescence, the first and second segments above striated.

Mount Gay Estate. Described from one female specimen.

(4) HADRONOTUS GRENADENSIS, sp. n.

♂. Length 1·2 mm. Black, subopaque, coarsely irregularly rugose; scape and legs, except coxæ, brownish yellow; flagellum filiform, brown-black. Wings hyaline, the venation yellowish, the marginal vein stout, half as long as the stigmal. Facial impression transversely striated, margined; first flagellar joint as long as the pedicel, or a little longer, second and third joints quadrate, those beyond transverse-quadrate, the last ovate, twice as long as the penultimate. Abdomen, except first segment, opaque, granulated, the first segment shining, striated, half as long as the second; third segment scarcely one-third the length of the second, the following segments very short.

Mount Gay Estate. Described from one male specimen.

SCELIO, Latreille.

SCELIO INSULARIS, Riley.

Mount Gay Estate. One male specimen.

Subfamily VI. PLATYGASTERINÆ.

INOSTEMMA, Haliday.

INOSTEMMA SIMILLIMA, Ashm. Journ. Linn. Soc. xxv., Zool. p. 232

Mount Gay Estate. Three female specimens.

AMBLYASPIS, Förster.

a. Scutellum ending in a long acute spine.

(1) AMBLYASPIS XANTHOCHROA, sp. n.

♀. Length 1 to 1·2 mm. Brownish yellow; ocelli and eyes black; flagellum, mesonotum posteriorly, body of abdomen, tips of hind femora, and the tibiæ dusky or black; scutellar spine very long, acute, extending far over the metathorax; club 4-jointed, the two middle joints a little longer than thick, the last joint ovate, about twice as long as the penultimate.

Balthazar, Chantilly and Mount Gay Estates. Described from three female specimens.

(2) AMBLYASPIS XANTHOPUS, Ashm. l. c. p. 236.

Balthazar, Grand Étang, Mount Gay Estate, St. George's, and St. John's River. Nineteen specimens.

(3) AMBLYASPIS GRENADENSIS, sp. n.

♂. Length 1 mm. Polished black; face and cheeks below piceous; antennæ, except club, and the legs, except posterior pair, brownish yellow, hind tarsi yellowish; joints of club about 3 times as long as thick, bearded with white hair; scutellar spine long, acute, yellowish.

Balthazar. Described from one male specimen.

b. Scutellum triangular, pubescent at tip, but not ending in a spine.

(4) AMBLYASPIS TRIANGULARIS, Ashm. l. c. p. 234.

Balthazar and Mount Gay Estate. Ten specimens.

(5) AMBLYASPIS RUFICORNIS, sp. n.

♀. Length 1·1 mm. Polished black; antennæ and legs, except middle and hind coxæ which are black, rufous. Wings subhyaline; scutellum triangular, pubescent; metapleura and petiole clothed with a pale pubescence; pedicel very long, 3 times as long as the first funicular joint; club dusky, the joints, except the last which is ovate, very little longer than thick.

Balthazar. Described from one female specimen.

(6) AMBLYASPIS BRUNNEUS, sp. n.

♀. Length 0·65 to 0·7 mm. Head dusky, the thorax and abdomen brown; scape, pedicel, legs, and petiole yellow, the flagellum light brown. Wings hyaline, ciliated. The pedicel is as long as the first two funicular joints united; funicular joints 2 to 4 moniliform; club 4-jointed, a little thicker than the funicle, joints 1 and 2 well separated, scarcely longer than wide, joints 3 and 4 closely united, the third transverse-quadrate, the last ovate.

Balthazar. Described from two female specimens. A small species, readily distinguished by the colour of thorax and abdomen and by the yellow scape and legs.

LEPTACIS, Förster.

LEPTACIS OBSCURIPES, Ashm. l. c. p. 236.

Balthazar. One female specimen.

POLYMECUS, Förster.

(1) POLYMECUS MACRURUS, sp. n.

♀. Length 2·5 mm. Polished black; scape, except at tip, and legs reddish yellow, the tips of middle and hind femora and tibiæ dusky or black; wings hyaline.

Head transverse, the lateral ocelli twice as wide from the front ocellus as to the eye-margin; funicle very slender; club stout, 4-jointed, joints 1 and 2 about equal, very slightly longer than thick, joint 3 quadrate, the last joint subglobose. The scutellum ends in a small tubercle; metapleura striated and clothed with some sparse glittering white hairs. Abdomen sessile, highly polished, the last three segments forming a very long, slender stylus, the three united being just twice as long as the rest of the abdomen, the thorax, and the head united.

Balthazar. Described from one female specimen.

(2) POLYMECUS GRENADENSIS, sp. n.

♀. Length 1 mm. Polished black; scape and legs brownish yellow, the tips of hind femora and tibiæ dusky; metapleura and base of abdomen with a silvery pubescence; scutellum armed with a small tubercle; last three segments of abdomen forming a stylus, but united not longer than the rest of the abdomen and thorax united, the penultimate segment being the longest, longer than the other two united.

Grand Étang. Described from one female specimen.

The antennæ were folded under the body in such a way as to prevent them from being studied; but the species may be readily recognized by the characters in the last three abdominal segments.

SACTOGASTER, Förster.

SACTOGASTER RUFIPES, Ashm. l. c. p. 238.

Mount Gay Estate. Eight female specimens.

SYNOPIAS, Förster.

SYNOPIAS FLAVIPES, sp. n.

♀. Length 0·65 mm. Polished black; antennæ, except the club, and legs, including the coxæ, yellow; club brown-black; wings hyaline. The funicle is slender, the first joint scarcely longer than thick, the second very slightly thicker, the third a little longer, the fourth minute; club 4-jointed, the joints, except the last, transverse-quadrate, the last ovate. Mesonotum entirely without furrows; tip of scutellum with a small tubercle; metathorax clothed with a silvery-white pubescence, while the abdomen is ovate.

♂. Differs from female only in the usual difference in the shape of the abdomen and in having a 5-jointed, light brown, antennal club, the joints being oblong and bearded, the second funicular joint being stouter and much longer than the first, the third minute.

Balthazar and Mount Gay Estate. Described from the female and two male specimens.

Subfamily X. DIAPRIINÆ.

Tribe i. SPILOMICRINI.

PARAMESIUS, Westwood.

PARAMESIUS THORACICUS, Ashm. Journ. Linn. Soc., Zool. xxv. p. 245.

Balthazar, Grenada. One female specimen.

SPILOMICRUS, Westwood.

SPILOMICRUS VULGARIS, Ashm. l. c. p. 247.

Balthazar. One female specimen.

Tribe ii. DIAPRIINI.

LOXOTROPA, Förster.

Table of Species.

Black.

Pleura rufous; antennæ 12-jointed, extending to base of abdomen; pedicel twice as long as the first funicular joint, the latter, twice as long as the second; funicular joints 2 to 5 moniliform .... *L. pleuralis.*

Pleura black; antennæ 12-jointed, longer than the body; pedicel oval, thicker at apex than the first funiclar joint is long; the funiclar joints 2 to 4 not longer than thick, 5 and 6 wider than long, 7 twice as wide as long .... *L. grenadensis.*

(1) LOXOTROPA PLEURALIS, sp. n.

♀. Length 1·5 mm. Polished black; antennæ, except the abrupt 3-jointed club, and the legs reddish yellow; club black; sides of thorax rufous; wings hyaline, ciliated, the stigma piceous; costæ and basal nervures hyaline or yellowish white.

Head globose, the frons emarginated, the face piceous; antennæ 12-jointed, reaching to base of abdomen, the funicle a little longer than the scape; pedicel twice as large as the first funicular joint; funicle 7-jointed, the first joint twice as long as the second, joints 2 to 5 moniliform, about equal in size, not longer than thick, joints 6 and 7 transverse; club abrupt, large, 3-jointed, black, the first and second joints transverse-quadrate, the third or last a little longer than the penultimate; scutellum with a moderate-sized fovea at base; metathorax clothed with a dense pubescence; abdomen oblong-oval, as long as the thorax, the petiole a little longer than thick, pubescent.

Balthazar. Described from one female specimen.

(2) LOXOTROPA GRENADENSIS, sp. n.

♀. Length 0·9 mm. Polished black; antennæ, except the abrupt 3-jointed club, and legs reddish yellow; club black; wings hyaline, ciliated, the stigma yellowish.

Head globose, the frons truncate; antennæ 12-jointed, longer than the body, the funicle twice as long as the scape, which is stout, obclavate; pedicel very stout, obconical, thicker at tip than the first funicular joint is long; funicle 7-jointed, the first joint only a little longer than thick, joints 2 to 4 not longer than thick, joint 5 very slightly wider than long, joint 6 a little wider, while joint 7 is still wider, or twice as wide as long; club abrupt, 3-jointed, the first and second joints quadrate, the last obtusely conical, a little longer than either of the others; collar pubescent at sides; scutellum with a large fovea at base; metathorax and petiole clothed with a griseous pubescence, the latter wider than long; body of abdomen oblong-oval, truncate at tip.

Balthazar. Described from one female specimen.

ACANTHOPRIA, Ashm., g. n.
(Type, *A. crassicornis.*)

Antennæ in ♀ 12-jointed, subclavate, the flagellum gradually incrassated towards tip and without a distinctly defined club; in ♂ 14-jointed, as in *Diapria*, pedicellate-verticellate; scutellum conic, ending in a spine and foveated at base; metathorax armed with an acute curved thorn or spine; wings as in *Diapria*; body of abdomen short oval, truncate at apex, the petiole short, stout.

This genus is separated at once from *Diapria* and *Tropidopria*, to which it is most closely allied, by the conic, spined scutellum, by the acute spine on the metathorax, the short oval abdomen, and by the antennal characteristics of the female.

ACANTHOPRIA CRASSICORNIS, sp. n.

♀. Length 1·4 mm. Polished black; antennæ, except the last 5 joints which are dusky or black, and legs red; metathorax and petiole of abdomen brown, pubescent; wings hyaline, ciliated.

The head is globose; antennæ nearly as long as the body, subclavate or gradually incrassated toward tips; scape long, half the length of flagellum, stout, extending far above the ocelli; pedicel about half as long as the first flagellar joint; flagellum stout, the first joint the longest, the following joints to the seventh gradually shortening, but increasing in width, the joints from 8th tapering toward apex. Mesonotum with two faint grooved lines posteriorly; scutellum conic, ending in a spine or thorn, with a deep fovea at base; metanotum armed with an acute prominent thorn or spine at base above, the metathorax and abdominal petiole rugulose; body of abdomen oval, much shorter than the thorax, its base overlapping the apex of the petiole; petiole a little longer than thick.

♂. Length 1·4 mm. Agrees structurally very closely with the female, except that the delicate grooved lines on the mesonotum are wanting; sometimes the thorax above anteriorly and at the sides is piceous or rufo-piceous; the antennæ and legs are reddish yellow, the former being about twice as long as the body, pedicellate-verticellate, exactly as in *Diapria*.

Balthazar and Mount Gay Estate. Described from one female and four male specimens.

DIAPRIA, Latreille.

Table of Species.

Females.

Body uniformly rufo-piceous	2.
Body mostly black.	
Thorax entirely black.	
Antennæ gradually incrassated, red, the first flagellar joint longer than the pedicel	*D. smithi.*
Thorax anteriorly and the abdomen beneath piceous or dark rufous, not entirely black.	
Club of antennæ 4-jointed, gradually incrassated, the last joint not twice as long as the penultimate, the last two joints black	*D. grenadensis.*

Club of antennæ abrupt, 3-jointed, the last joint twice as long as the penultimate, the last two joints black .... *D. peraffinis.*

2. Antennæ with a gradually incrassated 4-jointed club, reddish yellow.

Legs reddish yellow .... *D. unicolor.*

Males.

Body black.

Thorax entirely black; petiole of abdomen short.

Antennæ about twice as long as the body, reddish-yellow, the flagellar joints with long slender peduncles .... *D. smithii.*

Thorax anteriorly more or less piceous.

Antennæ not 1½ times as long as the body, reddish, the flagellar joints with short peduncles .... *D. grenadensis.*

Antennæ about 1¾ times the length of the body, reddish, the flagellar joints with long slender peduncles .... *D. peraffinis.*

Thorax rufous, the mesopleura black, abdominal petiole very long.

Antennæ about twice the length of the body, reddish yellow, the joints with long slender peduncles ... *D. melanopleura.*

(1) DIAPRIA SMITHI, sp. n.

♀. Length 2·2 mm. Polished black; antennæ and legs red; wings hyaline, pubescent, the stigma yellow.

Head globose, the cheeks sparsely pubescent; antennæ about as long as the body, the flagellum gradually incrassated, the scape long, about as long as the first four funicle joints united; pedicel shorter but a little stouter than the first joint of funicle; funicular joints 2 to 4 subequal, the fourth the stoutest, the six following joints, which in reality constitute the club, are moniliform and gradually incrassated; collar at sides and metathorax pubescent; scutellum with a large, deep fovea at base; abdomen ovate, the petiole rugose, pubescent, scarcely longer than thick.

♂. Length 1·8 mm. Differs from female in the shorter, oval abdomen, the petiole being nearly twice as long as thick, and by the long, nodose-pedicellate antennæ, which are red and about twice the length of the body, with whorls of long hair, the peduncle of each joint being as long as the nodose or swollen part, except those of the last three joints.

Chantilly Estate. Described from one male and one female specimen.

(2) DIAPRIA GRENADENSIS, sp. n.

♀. Length 1·5 to 2 mm. Polished black, the thorax anteriorly and the abdomen beneath with a distinct reddish or piceous tinge; antennæ, except last two joints, and the legs red or reddish yellow; wings hyaline, the stigma yellowish.

Head globose, the cheeks pubescent behind; antennæ extending to middle of abdomen, the club incrassated, the last two joints black; funicle 6-jointed, the first joint longer but slenderer than the pedicel, the following gradually shortening, the fifth and sixth stouter than the others, the sixth being twice as long as thick; club 4-jointed, the first joint oval, the second rounded, the third quadrate, the last conic; collar at sides, metathorax, and petiole densely pubescent; scutellum with a moderately large, but not deep fovea at base; metathoracic carina triangular, acute; body of abdomen ovate, the petiole about 1½ times as long as thick.

♂. Agrees well with the female in colorational detail, but with the antennæ 14-jointed, nearly 1½ times as long as the body, the flagellum either reddish piceous or reddish yellow, the second joint a little longer than the first, the following joints, except the last, which is as long as the second, all shorter and with scarcely any pedicel, the joints, however, with whorls of long hair.

Balthazar and Mount Gay Estate. Described from two male and nine female specimens.

(3) DIAPRIA PERAFFINIS, sp. n.

♀. Length 1 mm. Agrees well with *D. grenadensis*, except in its smaller size and in the decidedly different shaped antennæ. The antennæ are shorter, reaching scarcely to the apex of the metathorax, with the club abrupt, 3-jointed; the first funicular joint is shorter than the pedicel, only a little longer than thick, while the other joints are rounded or moniliform, not longer than thick, the last two being a little transverse; the first joint of the club is transverse-quadrate, the second quadrate, the last oblong, twice as long as the penultimate; scutellum with a small, shallow fovea at base; petiole of abdomen not longer than thick, pubescent.

The male, on the contrary, differs from that of *D. grenadensis* in having the antennæ much longer, nearly twice as long as the body, with the flagellar joints longly pedunculated, the petiole a little more than twice as long as thick.

Balthazar and St. George's. Described from one female and two male specimens.

(4) DIAPRIA MELANOPLEURA, sp. n.

♂. Length 2 mm. Head and abomen black; thorax, except the mesopleura which are black, rufous; antennæ and legs reddish yellow; wings hyaline, ciliated, the stigma yellowish.

Head globose; antennæ 14-jointed, nearly twice the length of the body, verticillate, the flagellar joints longly pedicellated; scutellum with a deep fovea at base; metathorax and petiole densely pubescent, the latter long, about 4 times as long as thick; body of abdomen black, but more or less reddish or pale at the juncture with the petiole.

Balthazar. Described from one male specimen.

(5) DIAPRIA UNICOLOR, sp. n.

♀. Length 1·6 mm. Uniformly rufous; antennæ and legs reddish yellow; wings hyaline, ciliated, the stigma yellowish.

Head globose; antennæ 12-jointed, not quite so long as the body, terminating in an incrassated 4-jointed club; first funicular joint shorter than the pedicel, about twice as long as thick, the others gradually shortening, the last being only a little longer than thick; first joint of club oblong, the second larger, rounded, the third still larger, quadrate, the last oblong; scutellum with a transverse fovea at base; sides of collar, metathorax, and petiole pubescent; petiole nearly 3 times as long as thick; body of abdomen ovate, pointed as tip, and as long as the thorax.

Balthazar. Described from one female specimen.

CERATOPRIA, Ashmead.

(1) CERATOPRIA GRENADENSIS, sp. n.

♀. Length 0·8 mm. Head and abdomen, except the petiole, black; thorax rufous; antennæ, except club, and the legs yellow; club abrupt, 3-jointed, black; wings hyaline, ciliated.

Head large, globose; funicle as long as the scape, the first joint a little longer than thick, the following transverse-moniliform, the last two joints very slightly wider than the preceding; club abrupt, 3-jointed, the first and second joints equal, transverse-quadrate, the last oval, a little longer than the preceding; scutellum with a single, small, rounded fovea at base; metathorax pubescent; abdomen oblong-oval, the body as long as the thorax, above black, beneath towards base piceous, the petiole yellow, shagreened.

Balthazar and Mount Gay Estate. Described from two female specimens.

(2) CERATOPRIA FLAVIPES, sp. n.

♀. Length 1 mm. Black; angles of pronotum and the antennæ, except the club, brownish yellow; club abrupt, 3-jointed, black; legs yellow; wings hyaline, ciliated.

Head subglobose, a little wider than long; scape scarcely as long as the funicle; funicle with the joints moniliform, the first not longer than thick, the last three a little transverse; club large, abrupt, 3-jointed, the last joint oblong, twice as long as the second; scutellum with a transverse shallow fovea at base; abdomen ovate, more pointed than usual; petiole and the metathorax piceous, pubescent.

Balthazar. Described from one female specimen.

TRICHOPRIA, Ashmead.

Table of Species.

Females.

Antennæ with a gradually incrassated 4-jointed club .... 2.
Antennæ with a gradually incrassated 5-jointed club.
  Antennæ rufous, the club black; scutellum with a single fovea, with a grooved line at the sides; legs reddish yellow .... *T. grenadensis.*

2. Antennæ, except last joint, reddish yellow, last joint black; scutellum with two minute, widely separated foveæ, a grooved line at sides; legs reddish yellow ...... *T. bifoveata.*
Antennæ, except last three joints which are dusky, yellow; scutellum with a single fovea at base; legs yellow .... *T. affinis.*

(1) TRICHOPRIA GRENADENSIS, sp. n.

♀. Length 1·5 mm. Polished black; antennæ 12-jointed, extending to base of abdomen, rufous, the club black; legs reddish yellow; wings hyaline, pubescent, the stigma yellow.

Head globose; flagellum three times as long as the scape, the pedicel thicker and a little longer than the first joint of funicle, the first funicular joint the longest, the following gradually shortening, all, however, longer than thick; club gradually incrassated, the last joint ovate but not longer than the penultimate; sides of collar pubescent; scutellum with a single fovea at base; angles of metathorax acute, pubescent at sides; abdomen oblong-oval, as long as the thorax, with the petiole short, pubescent.

♂. Agrees with the female, except in having long, 14-jointed antennæ, the flagellum being black or piceous, the joints elliptic-oval, covered with sparse long hairs, the first joint being slightly the longest.

Balthazar and Grand Étang. Described from one female and two male specimens. The male comes nearest to *T. insularis*, described from St. Vincent, but the antennæ are differently coloured, with the joints differently shaped.

(2) TRICHOPRIA BIFOVEATA, sp. n.

♀. Length 1·4 mm. Polished black; antennæ 12-jointed, extending to base of abdomen, reddish yellow, with the last joint black; legs reddish yellow; wings hyaline, ciliated.

Head globose; flagellum 2½ times as long as the scape, the pedicel twice as long as thick and longer and stouter than the first flagellar joint; first funicular joint a little longer than the second, the joints after the second moniliform, not longer than thick; club gradually incrassated, 4-jointed, the last joint greatly enlarged, oblong, nearly as long as the three preceding joints united and much stouter; scutellum with two minute widely separated foveæ at base (in reality punctures); metapleura and petiole pubescent or woolly; body of abdomen ovate, acute at tip.

Balthazar. Described from two female specimens.

(3) TRICHOPRIA AFFINIS, sp. n.

♀. Length 0·8 mm. Polished black; antennæ 12-jointed, extending to the middle of abdomen, yellow, the last three joints of club black or dusky; legs yellow; wings hyaline, ciliated.

Head globose; flagellum about 4 times as long as the scape, the pedicel much thicker but scarcely longer than the first joint of funicle; funicular joints 1 to 4 gradually shortening, all longer than thick, 5 and 6 moniliform and a little wider than the preceding; club 4-jointed, loosely joined, gradually incrassated, the first joint the smallest, the last much the largest, oblong, as long as the two preceding united; scutellum with a single fovea at base; collar at sides, metapleura, and petiole woolly, the latter yellowish; abdomen oval, not quite so long as the thorax.

Balthazar. Described from a single female specimen.

This species comes nearest to *T. flavipes*, but it is much smaller, with the joints of the funicle quite differently shaped.

PHÆNOPRIA, Ashmead.

Table of Species.

Females.

Antennæ with a 3-jointed club, the last joint of which is enlarged, ovate or oblong.......................... 2.
Antennæ with a 4-jointed club, red or reddish yellow, except more or less of the club.
  Funicle 6-jointed, the first joint 2½ times as long as thick, second and third joints shortening, a little longer than thick, joints 4 to 6 moniliform, slightly widening; last two joints of club, black. *P. grenadensis.*
  Funicle 6-jointed, the first joint only a little longer than thick; joints 2 to 6 moniliform, very slightly widening; club black .... *P. nigriclavata.*
2. Club unusually large, as long as the funicle .... 4.
  Club not unusually large, only about two-thirds the length of the funicle.
    Antennæ, except the club or 1 or 2 joints of club, red or reddish yellow .... 3.
    Antennæ, except sometimes the funicle, black or fuscous.
      Funicle 7-jointed, the first and second joints subequal, longer than thick, joint 3 and those beyond not longer than thick, the last three slightly transverse; coxæ and clavate parts of the legs piceous or black .... *P. subclavata*, Ashm.
      Funicle 7-jointed, the first joint scarcely longer than thick, the second and following small, moniliform, not longer than wide, the last two or three a little wider than long; coxæ sometimes and clavate parts of legs piceous. *P. simillima*, Ashm.
3. Funicle 7-jointed, first joint 2½ times as long as thick, joints 2 to 6 gradually shortening, the 6th being 1½ times as long as thick, the 7th a little thicker; legs and petiole yellow .... *P. balthazari.*
  Funicle 7-jointed, first joint twice as long as thick, the second two-thirds the length of first, the third and following scarcely as long as thick; legs reddish yellow, with the clavate parts sometimes piceous .... (*P. subclavata.*)
  Funicle 7-jointed, the first joint scarcely longer than thick, the following small, moniliform, the last two or three a little wider than long; legs reddish yellow, with sometimes the clavate parts piceous ... (*P. simillima.*)
4. Antennæ, except club, and legs reddish yellow.
  Funicular joints, except the first, not longer than wide; club abnormally large, the first joint transverse-quadrate, the second larger, quadrate, the third oblong, one-half longer than the second; petiole broader than long or as broad .... *P. magniclavata.*

Males.

Black; trochanters, slender parts of femora, and tibiæ and the tarsi, reddish yellow. Antennæ 14-jointed, black, much longer than the body, the second flagellar joint longer than the second, constricted at base but not angulated at one side, the joints beyond elongate ellipsoidal, with short pubescence	*P. nigricornis.*
Black; legs rufous. Antennæ 14-jointed, black, not much longer than the body, the second flagellar joint a little longer than the first, angulated towards one side, the joints beyond ellipsoidal	*P. angulifera.*

(1) PHÆNOPRIA NIGRICORNIS, sp. n.

♂. Length 1·8 mm. Polished black; legs brownish yellow, the coxæ and clavate parts piceous or blackish; wings hyaline, ciliated, the stigma piceous; antennæ black.

Head globose; antennæ 14-jointed, 1½ times as long as the body, the scape brownish at base, as long as the first three flagellar joints united; pedicel about half as long as the first joint of flagellum; second joint of flagellum a little longer than the first, constricted toward base, the third about as long as the first, the following to the last elongate ellipsoidal, the last longer than the penultimate; all the joints with sparse, short hairs. Metanotum with a prominent triangular-shaped carina; sides of collar, the metapleura, and the petiole clothed with a griseous pubescence. Abdomen elongate-oval, obtuse at tip, the petiole short, stout.

St. John's River. Described from one male specimen.

(2) PHÆNOPRIA ANGULIFERA, sp. n.

♂. Length 1·5 mm. Polished black; legs rufous; antennæ 14-jointed, brown-black; wings hyaline, ciliated, the stigma yellowish.

The antennæ are slightly longer than the body, the second joint of flagellum a little longer than the first and distinctly angulated below, the following joints to the last ellipsoidal, gradually shortening, the last joint pointed and as long as the the second; all joints covered with a short, sparse pubescence. Collar, metapleura, and petiole clothed with a glittering white pubescence. Metanotum with a triangular-shaped keel at base; body of abdomen elongate-oval.

Balthazar. Described from one specimen.

Comes nearest to *P. nigricornis*, but is smaller, with shorter antennæ and different-coloured legs.

(3) PHÆNOPRIA ANGULIFERA, sp. n.

♀. Length 1 to 1·3 mm. Polished black; antennæ, except last joint (or the last two joints), and legs reddish yellow; wings hyaline, ciliated, the stigma brown.

Head globose; antennæ 12-jointed, with a 4-jointed club, as long as the body; funicle 6-jointed, the first joint 2½ times as long as thick, the second and third shortening but longer than thick, joints 4 to 6 moniliform, slightly widening; club 4-jointed, the last joint or the last two joints black, the first joint moniliform, the second and third larger, transverse, the fourth much larger, oblong, as long as or a little longer than the two preceding united. Collar, metathorax, and petiole pubescent. Abdomen pointed-ovate, as long as the thorax, the petiole about as long as thick.

Balthazar and Mount Gay Estate. Described from six specimens.

This species is distinguished from the other species by the relative length of the funicular joints.

(4) PHÆNOPRIA NIGRICLAVATA, sp. n.

♀. Length 1 mm. Polished black; antennæ, except the 4-jointed club, and legs reddish yellow; wings hyaline, ciliated, the stigma yellowish.

Head globose; antennæ 12-jointed, extending scarcely to the middle of the abdomen; funicle 6-jointed, the first joint only a little longer than thick, the following moniliform, slightly increasing in size but not longer than wide; club 4-jointed, dusky or black, the joints increasing in size, the last very little longer than the penultimate; metapleura pubescent. Abdomen as long as the thorax, oblong, the petiole wider than long, brownish.

Chantilly Estate. Described from one female specimen.

Distinguished by the shorter antennæ, the relative length of the joints of funicle, and by the 4-jointed black club.

(5) PHÆNOPRIA SUBCLAVATA, Ashm. Journ. Linn. Soc., Zool. xxv. p. 254.

Balthazar, Mount Gay Estate, St. George's and Vendôme.

This species, originally described from St. Vincent, is represented by 17 female specimens.

It is exceedingly variable in the colour of the antennæ and legs, and the characters of the antennæ, pointed out in the table, must be depended upon for the specific distinction.

(6) PHÆNOPRIA BALTHAZARI, sp. n.

♀. Length 1·2 mm. Polished black; antennæ, except the last two joints, and legs reddish yellow; wings hyaline, ciliated, the stigma yellow.

Head globose; antennæ 12-jointed, about as long as the body, ending in a 3-jointed incrassated club, the last two joints of which are black; funicle 7-jointed, the first joint 2½ times as long as thick, joints 2 to 6 gradually shortening, the 6th being 1½ times as long as thick, the 7th stouter; club 3-jointed, the first joint rounded, the second quadrate, while the third is oblong and a little longer than the second. Metathorax pubescent. Abdomen pointed-ovate, as long as the thorax without including the petiole, black, but beneath near base piceous; petiole about twice as long as thick, yellowish.

Balthazar. Described from two female specimens.

Distinguished from other species by the longer funicular joints and by the petiole.

(7) PHÆNOPRIA SIMILLIMA, Ashm. l. c. p. 254.

Balthazar and Mount Gay Estate.

Originally described from St. Vincent.

(8) PHÆNOPRIA MAGNICLAVATA, sp. n.

♀. Length 1 mm. Polished black; antennæ, except club, and legs reddish-yellow; club abnormally large, 3-jointed, black (sometimes with the first joint pale); wings hyaline, ciliated, the stigma piceous.

Head globose; antennæ 12-jointed, shorter than the body; funicle 6-jointed, as long as the scape, all the joints, except the first, moniliform, not longer than wide, the first a little longer than wide; club very large, 3-jointed, the first joint transverse, subquadrate, the second larger, wider, quadrate, while the third is still larger, oblong, one-half longer than the second. Pronotum at sides and the metapleura clothed with a glittering white pubescence. Abdomen oblong-oval, the petiole short, a little wider than long.

Grand Étang and Mount Gay Estate. Described from three female specimens.

6. On the Buccal Glands and Teeth of certain Poisonous Snakes. By G. S. West, A.R.C.S., Scholar of St. John's College, Cambridge.[1]

(Plates XLIV.–XLVI.)

[Received October 8, 1895.]

The structure, arrangement, and relationships of the buccal glands and teeth of poisonous Snakes, although an extremely interesting subject, is one upon which very little work has been recently done. Conspicuous among recent papers is one by Niemann[2], dealing with the structure and relationships of the glands of the upper lip in a few genera[3]. My own observations differ considerably from his in many points. He describes and figures the glands as consisting of long convoluted tubules, whereas

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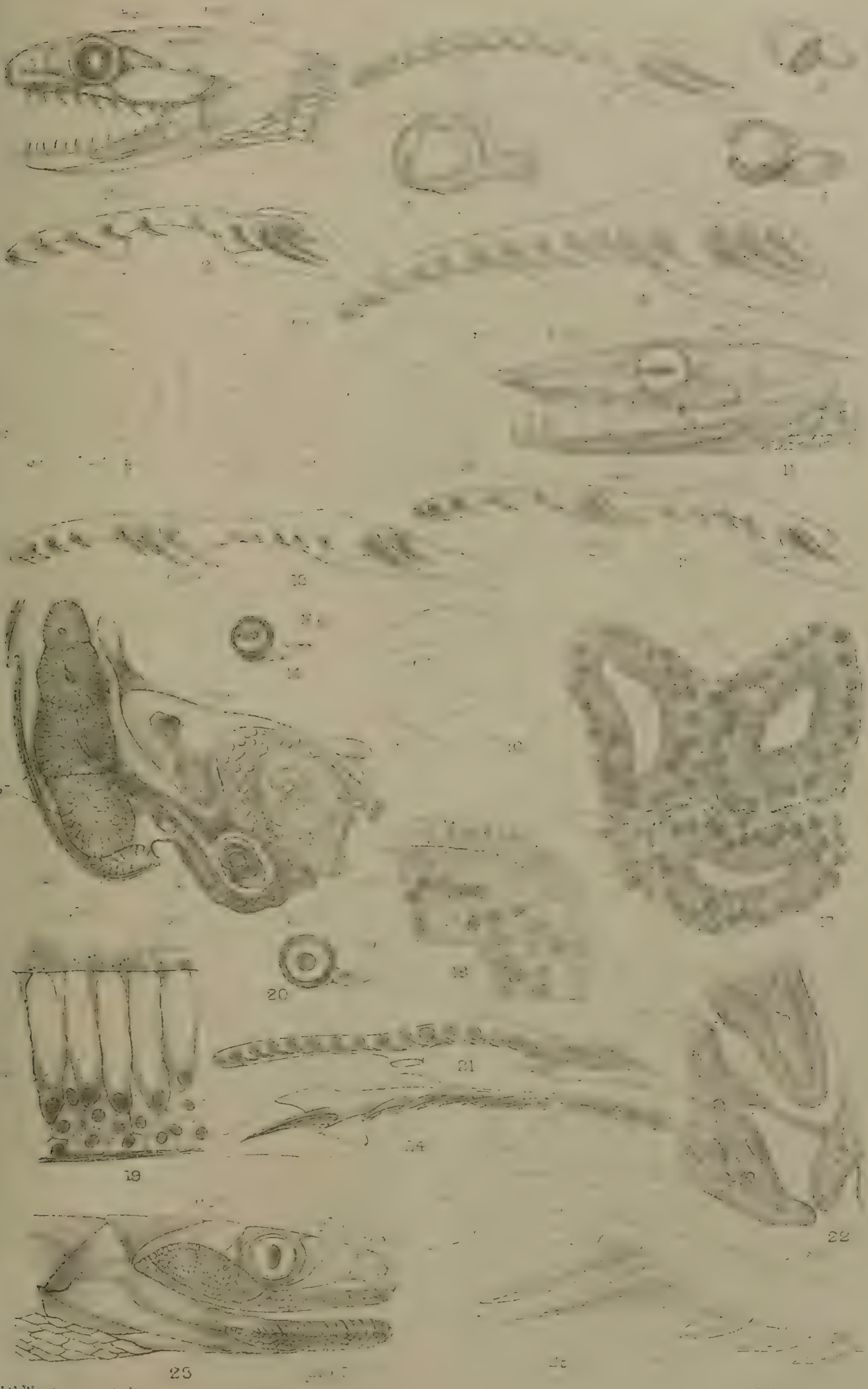
[1] From the Biological Laboratory of the Royal College of Science.

[2] F. Niemann, "Beiträge zur Morphologie und Physiologie der Oberlippendrusen einiger Ophidier." Arch. f. Nat. 1892, Band i. Heft 3.

[3] He deals only with three genera of Opisthoglyphous Snakes, one species of each of the following:—*Tragops* (*T. prasinus*, which he figures, t. xiv. f. 5), *Dipsas* (*D. annulata*), and *Psammodynastes* (*P. pulverulentus*).

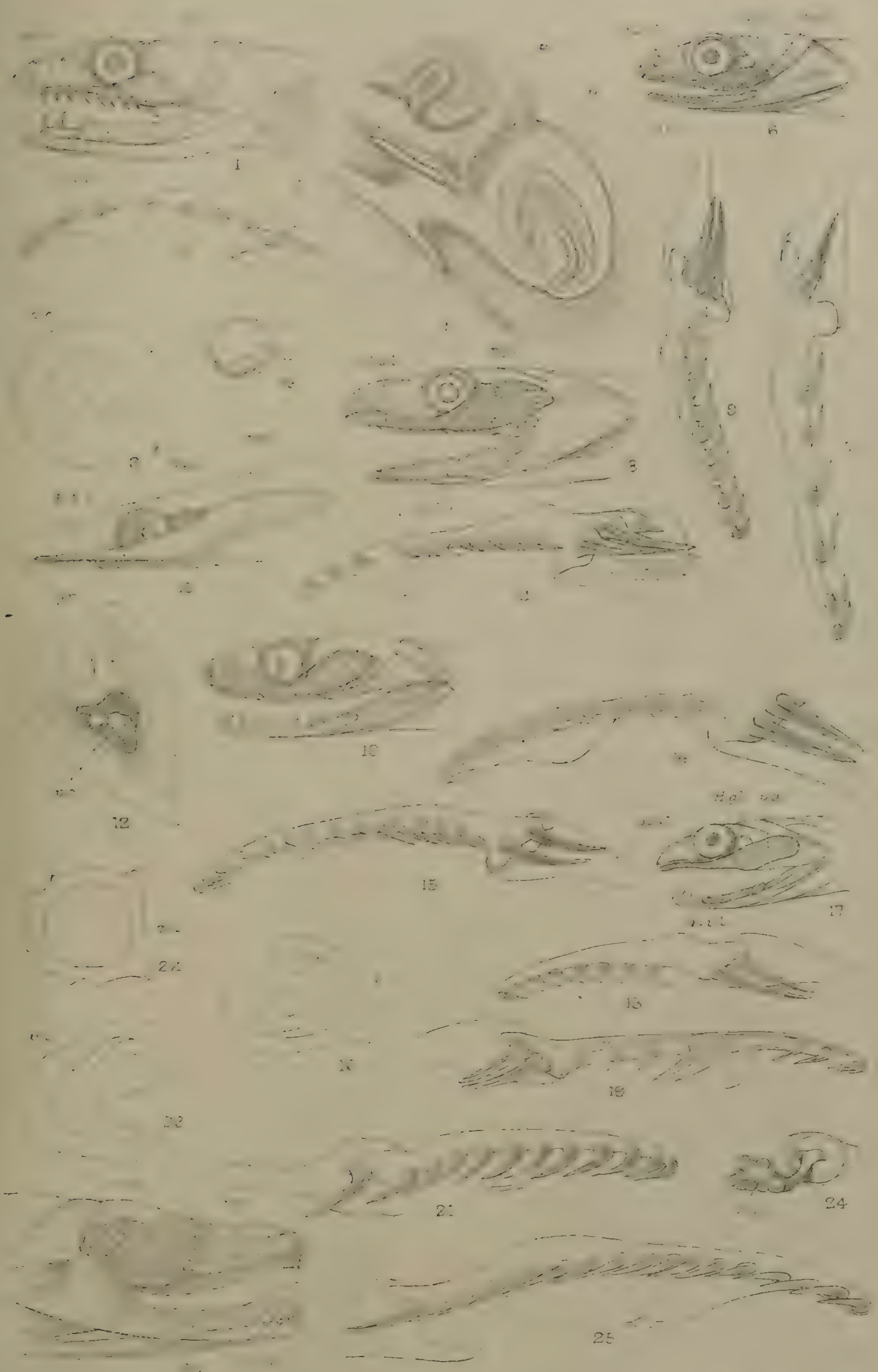


C.S. West ad nat. del.
M.P. Parker lith.

West, Newman imp.

Buccal glands & teeth of poisonous Snakes.
(Opisthoglypha.)

BRITISH MUSEUM NATURAL HISTORY

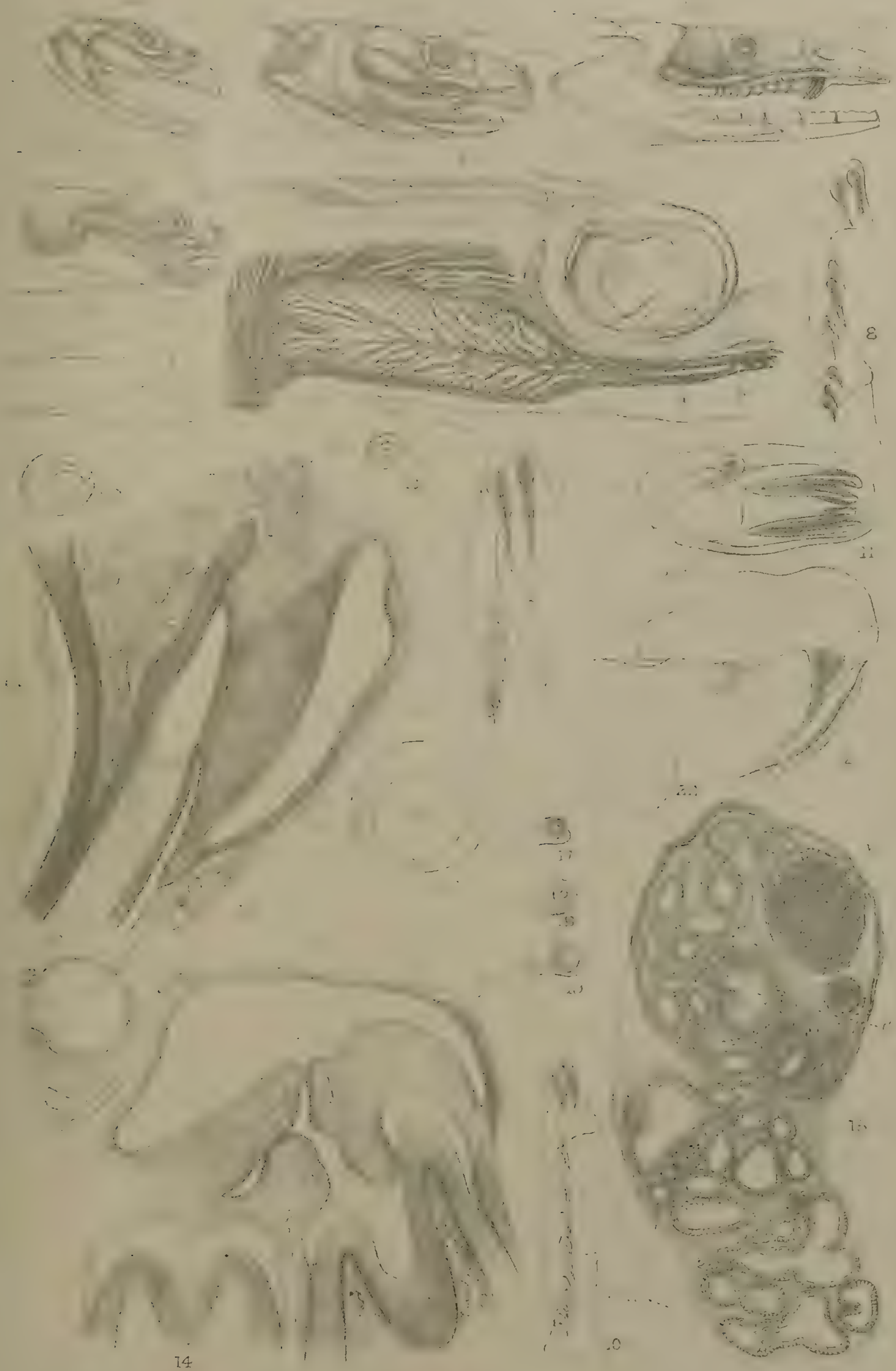


G.S.West ad nat.del.
M.P.Parker lith.

West, Newman imp.

Buccal glands & teeth of poisonous Snakes.
(Opisthoglypha.)

BRITISH MUSEUM NATURAL HISTORY



G.S.West ad nat.del.
M.F.Parker lith.
West Newman imp.

Buccal glands & teeth of poisonous Snakes.
(Proteroglypha.)

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I always find them to conform to the tubulo-racemose type, and to consist of small polygonal lobules arranged round the branches of a duct. Moreover the nuclei are situated at the base of the cells and not in the middle, this being most markedly the case in the Proteroglypha, where the nuclei are more or less flattened against the bases of the cells.

The Snakes treated of in this paper belong to the Colubridæ, and all come under two of Boulenger's groups, viz.—the *Opisthoglypha* and the *Proteroglypha*. Of the latter only the Marine Snakes (the *Hydrophiinæ*) are here dealt with. Unfortunately many of the specimens were insufficiently preserved for histological purposes. They formed part of the teaching collection at the Royal College of Science, which Professor G. B. Howes kindly placed at my disposal, together with specimens that he obtained for me from the Natural History Museum and elsewhere. My very best thanks are also due to him for suggesting this investigation, and for many hints and much valuable information received during its progress, and to Mr. G. A. Boulenger for kind assistance.

COLUBRIDÆ.

OPISTHOGLYPHA.

Whether Opisthoglyphous Snakes should be regarded as truly poisonous or not is a matter over which there hangs considerable doubt. The gland in these Snakes which communicates with the posterior grooved teeth is functionally[1] very similar to that gland which is in communication with the fangs of the Proteroglyphous Snakes[2]. In structure it is somewhat different, but I refer to it throughout this paper as the "poison-gland," as it is undoubtedly the homologue of that structure present in the Viperine and Proteroglyphous forms. It is of a more or less oval form, always situated posterior to the eye, and as a rule a little below it, its anterior extremity never reaching beyond the middle of that organ.

The *superior labial gland* is an elongated band of glandular tissue extending along the whole of the upper jaw and skirting the lower edge of the poison-gland, encircling its lower half in such a manner that the two glands are often superficially indistinguishable, apparently forming one continuous structure (Pl. XLIV. fig. 11; Pl. XLV. fig. 10). Both glands exhibit a superficial lobulation, the lobules being polygonal in form and generally a little larger in the superior labial gland; there is often also a marked difference in colour between the two glands, the poison-gland being of a much lighter colour—generally a light yellow (in spirit-specimens), whilst the superior labial gland inclines to brown. The latter decreases in bulk anteriorly and opens into the mouth by a series of about twenty ducts, which are arranged along the entire length of the gland, the orifices lying just within the inturned edge of the lowest lateral series of scales (Pl. XLIV. fig. 15, *d.s.l.*), and consequently only just within the mouth. It really consists of a series of small closely adpressed racemose glands, the ducts near their orifices having an average external diameter of 65 μ and an average internal diameter of 17 μ.

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[1] The bite of *Dryophis* and other Opisthoglyphous Snakes has been proved by several observers to be fatal to small animals.

[2] The former is more or less embedded in the superior labial gland, whereas the latter is almost isolated from it, the superior labial gland here attaining its greatest bulk at the anterior extremity of the jaw.

The *inferior labial gland* extends along the outer face of the mandible, and is very similar in form to the superior labial gland, though as a rule it is not so elongated; it possesses the same arrangement of its ducts, though the number is more variable. Both these glands are disposed in such a manner as to hide to a great extent the maxillary and mandibular teeth.

The structure of the labial glands is similar to that of a salivary gland with rather large alveoli. The gland-cells are shortly columnar (polygonal when seen from above) and the nuclei are basal in position; the lining epithelium of the ducts, even up to their very orifices, consists of precisely similar cells. The cell-contours, nuclei, and that portion of the cell-contents immediately surrounding the nucleus stain very clearly.

The alveoli of the *poison-gland* are smaller than those of the labial glands (Pl. XLIV. fig. 17), though their size, as also the comparative size of their constituent cells, varies considerably in the different genera of this group. The nuclei stain clearly, but the cell-contours and the finely granular cell-contents often stain very indistinctly; this will depend on the condition of activity of the gland. The Ehrlich-Biondi mixture was much used for staining sections of this gland and answered very well, if, after the sections had remained some time in that mixture, they were placed for a brief period in a very weak solution of picric acid; this had the effect of fixing the methyl green in the nuclei.

The duct of the poison-gland is very much larger than any of the ducts of the labial glands; it passes inwardly and downwardly and takes a slightly forward (or rarely a backward) direction from the gland. The duct, whilst still within the gland, has an epithelium of narrow columnar cells with basal or central nuclei (Pl. XLIV. fig. 18), but when nearing its point of exit the epithelial cells become larger and of different lengths with their bases somewhat pointed. Other polygonal cells are also present outside them, fitting into the interstices resulting from the different lengths of these cells. The nuclei are here situated at the extreme bases of the cells and are embedded in a denser cup-shaped mass of protoplasm, the rest of the cell being quite clear and resistant to the action of stains (Pl. XLIV. fig. 19). These cells are typical mucus-secreting cells, precisely similar to those of the mucous membrane of the mouth[1]. The duct either opens into the cavity formed by the muscular folds surrounding the grooved tooth, or becoming enlarged it communicates with the cavity surrounding the tooth by an aperture about equal in diameter to that of the duct. This opening is always towards the outer side of the grooved tooth (the first one when more than one is present), and may be situated either at the base of the tooth or a little way from it (Pl. XLIV. fig. 15; Pl. XLV. fig. 5). It will be seen from the above that the duct is not itself in direct communication with the groove of the tooth, but that the two communicate through the mediation of the cavity enclosed by the muscular folds surrounding the tooth, which are united in front. Consequently the loss of the tooth does not cause any injury to the duct, and in a short time one of the reserve teeth takes the place of the lost one. There are usually about half a dozen reserve teeth in successive stages of development behind the functional one, and they are in no way connected with the duct until called upon to replace a tooth that has been damaged or lost. The reserve teeth are posterior and internal to the functional ones, and are developed under cover of the expanded anterior extremity of the transpalatine bone; their positions are indicated in fig. 11, Pl. XLV.

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[1] The mucous membrane of the mouth of this group of Snakes is thrown into a series of longitudinal folds and the epithelium consists entirely of similar secretory cells to those described above.

The *grooved teeth* are situated at the posterior extremity of the maxilla, and their number varies from one to three in different genera and species. They are generally much larger than the other maxillary teeth and also straighter, though, like them, they are directed backwards at a considerable angle. Some of the teeth are almost circular in section, others compressed, and all are more or less irregular. A few have distinct cutting-edges on the posterior face of the tooth, e. g. *Leptodira rufescens* (Pl. XLV. fig. 12), *Thamnodynastes nattereri* (Pl. XLV. fig. 16). The groove is situated as a rule on the antero-external face of the tooth, though in three observed cases it is directly external in position, viz.—*Dryophis prasinus* (Pl. XLIV. fig. 12), *D. mycterizans* (Pl. XLIV. fig. 13), and *Oxybelis fulgida* (Pl. XLIV. fig. 21). In some the groove is almost closed, whereas in others it is widely open. It also varies in its extent down the tooth, for whereas in a few it almost reaches the extreme apex, in others, of which *Dipsas irregularis* is a notable example, it does not extend more than two-thirds of the way down.

The *mandibular teeth* are as a rule about the same size and often more numerous than the maxillary, and they decrease in size in an antero-posterior direction; the most anterior teeth are more crowded and also placed in a more upright position than the maxillary teeth. The curvature is generally confined to the upper half of the tooth, and they are never recurved at the apex as is so often the case with the maxillary teeth.

The *Harderian gland* in this group of Snakes is very variable in form and size, and may or may not be visible on removing the skin. In some it is a small elongated glandular mass, whereas in others it possesses two or three lobes and is of considerable bulk. A portion of it is always situated behind the eye, in the orbit.

The arteries supplying the Harderian and poison-glands arise from the ophthalmic artery which crosses the lower half of the orbit. The branch to the Harderian gland arises from one side, and that to the poison-gland on the other, just before this artery enters the orbit. The branch to the poison-gland enters that about the middle and then bifurcates, one branchlet running anteriorly and one posteriorly. Side by side with these arteries there run corresponding veins. The labial glands are supplied by branches of the maxillary and mandibular arteries.

These statements are based upon observations made upon the undermentioned genera, each of which may now be dealt with in greater detail.

Genus DIPSAS.

Species examined:—*D. irregularis*, *D. ceylonensis*, *D. fusca*, and *D. dendrophila.*

The poison-gland in all the species is clearly definable from the superior labial gland; the latter extends anteriorly but a short distance in *D. fusca* (Pl. XLIV. fig. 1) and *D. ceylonensis*, whereas in *D. dendrophila* and more especially in *D. irregularis* it extends to the anterior extremity of the jaw. The inferior labial gland is also more extensive in the latter species. The lobules are much smaller in *D. fusca* and *D. irregularis* than in *D. ceylonensis* and *D. dendrophila.* The Harderian gland is two-lobed in *D. fusca* and *D. ceylonensis* (Pl. XLIV. figs. 6 and 7), but three-lobed in the other two species, two of the lobes being within the orbit (Pl. XLIV. fig. 5). The maxilla of *D. fusca* (Pl. XLIV. fig. 2) possesses much fewer teeth than those of the other three species. There are 7 solid teeth and 3 posterior grooved teeth; of the latter, two are large ones and the third is much smaller and more curved. *D. dendrophila* and *D. irregularis* each possess 3 posterior grooved maxillary teeth, the terminal one in each case being the smallest (Pl. XLIV. fig. 4). The maxilla of the former has 12 solid teeth and that of the latter 14. The maxilla of *D. ceylonensis* (Pl. XLIV. fig. 3) possesses 2 large grooved teeth of equal size and 12 solid ones.

Genus DRYOPHIS.

Species examined:—*D. prasinus* and *D. mycterizans.*

The poison-gland in this genus is proportionately smaller than in any other genus examined, and superficially is not readily distinguished from the superior labial gland (*vide* Pl. XLIV. fig. 11). The Harderian gland is of very small bulk and consists of a mere strip of glandular tissue under and posterior to the eye (Pl. XLIV. fig. 14). The maxilla of *D. mycterizans* (Pl. XLIV. fig. 13) possesses 4 anterior small teeth, three median large ones, then 5 more small ones, and finally two large grooved teeth. That of *D. prasinus* (Pl. XLIV. fig. 12) possesses 5 anterior small teeth, a median very large and stout tooth, then 4 more small ones, and finally one large grooved tooth. The grooves of the posterior maxillary teeth of these Snakes are on the external face of the tooth, and are slightly to one side of the axis (Pl. I. fig. 16) (this is also the case in *Oxybelis*). The blood-vessels supplying the maxillary teeth form considerable blood-sinuses around the bases of the large median teeth; this was more particularly noticed in *D. prasinus*. These sinuses are in direct continuity with the blood-vessels in the pulp-cavity of the tooth, and lie at the base of the large longitudinal furrow between the pterygoid and the maxilla. They just underlie the glandular epithelium of the mouth, being separated from it only by a thin layer of connective tissue.

The mandibular teeth increase in size from the first to the fifth in *D. mycterizans* and then follows a series of much smaller teeth; in *D. prasinus* they increase in size from the first to the third, the latter being the largest tooth in the head, and these are then followed by 10 smaller teeth.

Genus OXYBELIS.

Species examined:—*O. fulgida.*

The poison-gland is very clearly defined and the superior labial gland is exceedingly long and narrow; it reaches to the anterior extremity of the maxilla and consists of much smaller lobules than the poison-gland. The inferior labial gland is also greatly elongated, reaching from the anterior extremity of the mandible almost to the articular condyle, and is more extensive than that of any other of the Snakes examined. The Harderian gland (Pl. XLIV. fig. 20) is precisely similar to that of *Dryophis*. The maxilla (Pl. XLIV. fig. 21) possesses more teeth than that of any other of the Snakes examined, there being 20 in one uninterrupted series. The first 17 are equal in size and much curved; the posterior three are a little larger, compressed laterally, and the external face of each possesses a very shallow groove. The muscular folds surrounding these three posterior teeth are not united in front, and in consequence of a thin muscular fold across the base of the anterior grooved tooth the poison-duct in this Snake is placed in communication with the interior of the mouth before it is with the groove of the tooth (Pl. XLIV. fig. 22).

The mandibular teeth are 18 in number. The first 8 are of equal size and slightly larger than the maxillary teeth; these are followed by 10 much smaller closely-set teeth.

The only difference between this genus and the preceding one (*Dryophis*) is in the absence of the large median maxillary fangs and in the circular pupil, the latter being elongated in a horizontal direction in *Dryophis*.

Genus ETEIRODIPSAS.

Species examined:—*E. colubriens.*

The poison-gland is clearly defined and the lobules are very small; the superior labial gland is rather more extensive than usual

(Pl. XLIV. fig. 23), and the Harderian gland is not visible on removal of the skin, the posterior lobe being small and downwardly directed behind the poison-gland. The maxilla (Pl. XLIV. fig. 24) possesses 12 much attenuated teeth, which are followed by a solitary larger grooved tooth. There are 17 mandibular teeth. The anterior extremity of the mandible, with the first three teeth, is slightly constricted off from the rest and bent downwards and inwards, but no suture is present. This peculiar condition of the anterior end of the mandible has not been observed in any other Snake.

Genus Cœlopeltis.

Species examined:—*C. lacertina.*

The poison-gland is clearly defined and triangular in form (Pl. XLV. fig. 1). The Harderian gland (Pl. XLV. fig. 4) has but a very small lobe outside the orbit and this is not visible externally. The maxilla (Pl. XLV. fig. 2) possesses 9 teeth; the posterior tooth is large, grooved, straighter and less attenuated than usual, the attenuation being confined to the very apex. The first 8 teeth are all of equal size and about one-third as large as the grooved one. There are also 9 mandibular teeth; the three anterior teeth are very large, but the 6 posterior ones are quite small and separated from them by a marked interspace.

Genus Philodryas.

Species examined:—*P. schottii* and *P. olfersii.*

In *P. schottii* the glands of both the upper and lower lips are of comparatively large size, and the poison-gland is superficially indistinguishable from the superior labial (Pl. XLV. fig. 8). The Harderian gland has an anterior lobe lining the lower half of the orbit, and a posterior elongated lobe just visible externally above the superior labial gland. The maxilla (Pl. XLV. fig. 9) possesses 12 teeth. The two posterior of these are large, grooved, and almost straight, they are not in a line with the others and are separated from them by a wide diastema; the 10 preceding teeth form a uniform closely-set series.

The mandibular teeth are 8 in number; there are 4 uniform anterior teeth equal in size to the maxillary, and then a diastema followed by 4 more very small teeth.

The folds surrounding the grooved teeth are only united in front of the bases of the first tooth, their lower portions being free.

In *P. olfersii* the glands are not by any means so extensive (Pl. XLV. fig. 6), and the maxilla possesses but 7 teeth, there being 6 solid widely separated teeth, followed by a rather large grooved fang (Pl. XLV. fig. 7).

Genus Psammodynastes.

Species examined:—*P. pulverulentus.*

The specimen of this Snake examined was in a damaged condition.

There were two posterior, almost straight, grooved teeth (Pl. I. fig. 25), preceded by a few small teeth which were larger anteriorly.

The mandibular teeth were 10 in number, the 3 anterior ones large and followed by 7 smaller teeth.

Genus PSAMMOPHIS.

Species examined:—*P. sebelans.*

The only available specimen of this Snake had been at some period dried, and consequently the teeth only could be examined. The maxilla (Pl. XLV. fig. 19) possessed 10 teeth—three anterior small ones followed by a diastema, then two large teeth and three more small ones; the two posterior teeth were large grooved ones. There were 13 mandibular teeth, 2 anterior large ones and 11 very small ones; the first 3 small ones were separated by wide diastemata, and the 8 posterior ones grouped together.

Genus TRIMERORHINUS.

Species examined:—*T. rhombeatus.*

The poison-gland is here superficially indistinguishable from the superior labial gland, and extends a comparatively long distance posterior to the eye (Pl. XLV. fig. 17). The maxilla possesses 10 teeth; the 2 posterior ones are very large and grooved, and the 8 anterior ones are much smaller and of uniform size.

Genus THAMNODYNASTES.

Species examined:—*T. nattereri.*

The poison-gland is very clearly differentiated from the superior labial gland and exhibits a marked lobulation. The maxilla is somewhat slender and possesses altogether 16 teeth; the 2 posterior ones are large, grooved teeth, and the other 14 are smaller, much attenuated teeth (Pl. XLV. fig. 15). The grooved teeth possess a small, though marked, posterior cutting-edge (Pl. XLV. fig. 16).

The mandibular teeth are also 16 in number, but are not so crowded as the maxillary ones and are more upright.

Genus LEPTODIRA.

Species examined:—*L. rufescens* and *L. annulata.*

The poison-gland of *Leptodira rufescens* is superficially indistinguishable from the superior labial gland, and is of a most extraordinary form. Just posterior to the eye it has a sudden upward flexure, and is then continued backwards for a much greater distance than that observed in the gland of any other Opisthoglyphous Snake (Pl. XLV. fig. 10). Looking at the head from the side, the gland is seen to partially cover the lower portion of the eye; but, to compensate for this, the head is very broad and the eyes directed obliquely upwards and forwards. The maxilla

(Pl. XLV. fig. 11) possesses 14 teeth. The 3 anterior ones are of small size and separated by moderately large diastemata, then follow 8 closely-set teeth of slightly larger size, and after a small interspace the 3 posterior teeth. These latter do not form a continuous series with the others, but are set along the edge of the posterior expanded end of the maxilla. The first two are large and grooved, but the third is very small and *solid*. This is the only case I have yet met with in Opisthoglyphous Snakes where a solid tooth follows the grooved ones.

The poison-gland of *L. annulata* is clearly defined from the superior labial gland, and is of the more usual form. The Harderian gland is not externally visible on removal of the skin as in *L. rufescens* (Pl. XLV. fig. 13). The maxilla (Pl. XLV. fig. 14) has 9 small, rather stout teeth of uniform size, followed by 2 posterior large and rather straight grooved fangs. There are 9 mandibular teeth.

Genus HOMALOPSIS.

Species examined:—*H. buccata.*

The poison-gland in this Snake is very clearly defined and somewhat sigmoid in form. The superior labial gland does not extend so far back as usual, but is otherwise rather extensive. The inferior labial gland is also of considerable bulk, and all three glands exhibit a marked lobulation (Pl. XLV. fig. 20). The Harderian gland is of a most unusual form, only a small anterior lobe being within the orbit, whilst a large irregularly lobulated posterior portion lies under cover of the poison-gland (Pl. XLV. fig. 24). The maxilla has altogether 12 teeth (Pl. XLV. fig. 21). The first 11 are solid and of equal size, set very close together, and possess a character which is quite unique amongst the Snakes that I have examined. In transverse section, the anterior face of the tooth is seen to be quite plane, and there are two lateral cutting-edges; the posterior surface (which is in section about two-thirds of the arc of a circle) is longitudinally ridged (Pl. XLV. fig. 22). There are eight or nine of these ridges near the base of the tooth, but they run out towards the apex, near to which the tooth becomes almost triangular. The posterior tooth is much larger than the rest and is grooved; it is somewhat irregular in transverse section and the groove is widely open (Pl. XLV. fig. 23).

Genus CERBERUS.

Species examined:—*C. rhynchops.*

The only specimen of this Snake examined had the head considerably damaged, and one maxilla was all that could be isolated in an uninjured condition (Pl. XLV. fig. 25). It possessed 17 teeth, which were in one continuous series, the posterior one being a little larger than the rest and grooved.

This and the preceding genus belong to the *Homalopsinæ* or Freshwater Snakes.

PROTEROGLYPHA.

HYDROPHIINÆ.

The *poison-gland* in Marine Snakes is situated some distance posterior to the eye. It varies somewhat in external form, and consists of a large series of longitudinally disposed tubules which converge anteriorly towards a central duct; this passes from the anterior end of the gland as the poison-duct. These tubules are larger towards the central axis of the gland and become smaller and much branched towards the periphery. They have spacious cavities, and their lining epithelium consists of short regular columnar cells. The cell-contents are for the most part aggregated at the base of the cell, at which point the nucleus is situated; the rest of the cell presents a finely granular appearance.

The *poison-duct* is of rather large calibre, and small tubules open into it along its whole course from the gland to the teeth, though they become much fewer in number anteriorly. As the duct nears the poison-fangs it becomes sinuous, bends suddenly inwards at the anterior extremity of the maxilla, and on reaching a point just anterior to the bases of the two grooved teeth it enlarges, enclosing a more or less considerable transverse vertical cavity. Into this cavity project two large cushions of muscular tissue, one in front of each tooth (Pl. XLVI. fig. 13 and 14, *m*). The two cushions are precisely similar and quite distinct from each other, the vertical slit between them being the only communication between this cavity, enclosed by the enlarged termination of the poison-duct, and that enclosed by the folds which closely surround the teeth (Pl. XLVI. fig. 14). The muscular tracts extend a short distance parallel to the teeth down the inner edge of the fold. The fibres are arranged in such a manner that contraction would lessen the cavity at the termination of the duct, widen the passage between the two muscular cushions, and also bring the folds into closer approximation with the outer faces of the teeth. This ensures a free passage for the poisonous secretion from the duct to the bases of the grooved teeth. There is also a fold partitioning off the two grooved teeth from each other, and the secretion passes down one side to one tooth and down the other side to the other (*cf.* Pl. XLVI. fig. 14).

As in the Opisthoglyphous Snakes, the reserve teeth are never in communication with the poison-duct until they become functional owing to loss of teeth previously in use.

The labial glands are very similar to those previously described and have a series of ducts, which become very numerous at the anterior extremity of the jaw.

Genus ENHYDRIS.

Species examined:—*E. hardwickii.*

The superior labial gland is of very small bulk posteriorly and much elongated, being but a thin line of glandular tissue under the poison-gland. Anteriorly, however, it is greatly developed, and immediately below the nostril is of considerable bulk, sending off an upward prolongation anterior to that opening.

The poison-gland is elliptical in form, is posterior to and somewhat remote from the eye, and sends off anteriorly a horizontal duct (Pl. XLVI. fig. 2).

The Harderian gland (Pl. XLVI. fig. 19) is indistinctly divided into two lobes; the anterior one is the larger and forms a socket for the eye, the posterior one is entirely buried in the muscles and is not visible externally. The eyes in this family of Snakes are comparatively small, with small round pupils, and the orbit is filled up to a great extent by the Harderian gland.

The inferior labial gland is elongated and lies along the mandible external to the teeth.

The maxilla (Pl. XLVI. fig. 9) is short, reaching but a little way in front of the eye. At the anterior end it is transversely enlarged and bears two large grooved fangs placed almost side by side, one—the slightly posterior one—being external to the other. They are but slightly curved and are inserted so as to point almost directly backwards. After a considerable interspace there are 5 more small solid teeth placed close together, the last one being at the extreme posterior end of the maxilla. In transverse sections of the grooved teeth they are seen to possess at the extreme end an anterior cutting-edge (Pl. XLVI. fig. 22). This was present only in this genus amongst those examined, the tooth at the apex being compressed laterally or in a direction at right angles to that in the case of *Platurus*.

There are 10 mandibular teeth of approximately equal size, the anterior three being slightly further apart than the other seven.

Genus PLATURUS.

Species examined:—*P. fasciatus*.

The superior labial gland tapers behind as in *Enhydris*, but does not reach quite so far back.

The poison-gland is narrower and more elongated than in the former genus, and has a posterior downwardly curved portion not present in any of the other genera examined (Pl. XLVI. fig. 4).

The Harderian gland forms a socket for the eye here also, the optic nerve passing through the postero-internal lobe of the gland (Pl. XLVI. fig. 18).

The inferior labial gland is shorter and more robust than in *Enhydris*.

The maxilla is extremely short and comparable to that of an Elapine Snake (Pl. XLVI. figs. 11 and 12). It is of a very peculiar form, and the two grooved fangs are situated side by side on its ventro-anterior edge. These teeth are large, and at about half their length are bent somewhat suddenly; they are very sharp and of a somewhat peculiar form. When viewed from below they are seen to suddenly taper to an acute point near to the apex, the margins of the tooth being up to this almost parallel. When viewed from the side, the lower half of the tooth is seen to be very narrow and much attenuated. The apical portion of the tooth is thus compressed antero-posteriorly. The groove is relatively much larger than in the other genera (*vide* Pl. XLVI. fig. 21), and reaches to within a short distance of the apex, opening by a small (anterior) aperture on the flattened surface of the tooth; the opening at the base of the tooth is large. Besides the two grooved teeth there is also a small and much bent tooth, with a very obtuse apex, situated on the outer edge of the maxilla slightly nearer to the posterior end.

Genus DISTIRA.

Species examined:—*D. cyanocincta.*

The glands are very similar to those of *Enhydris* (Pl. XLVI. fig. 1). The superior labial gland is greatly developed anteriorly, and the poison-gland is much rounded posteriorly and slightly constricted in the middle. The inferior labial gland is long and narrow, and the Harderian gland (Pl. XLVI. fig. 17) possesses a larger posterior lobe than either *Enhydris* or *Platurus.*

The maxilla (Pl. XLVI. fig. 8) has two anterior grooved fangs, the outer one a little posterior to the inner, which are proportionately smaller than those in the two previous genera. There is a considerable interspace, and then 8 smaller teeth forming a somewhat irregular series. The first two or three only of these teeth showed any indications of a groove[1]. This was so in the maxillæ of two specimens.

In transverse section the grooved fangs are almost circular.

Genus HYDRUS.

Species examined:—*H. platurus* and *H. platurus* var. *alternans.*

The superior labial gland is not so large as in the three previous genera. The poison-gland is partially under cover of a mass of muscular tissue; it is long and narrow, is partially constricted in the middle, and extends inwardly a considerable distance (Pl. XLVI. figs. 3, 6, and 7). The Harderian gland is not differentiated into two lobes, and is comparatively smaller than in the other genera examined (Pl. XLVI. fig. 16).

The maxilla (Pl. XLVI. fig. 10) possesses two anterior grooved fangs, the inner one being slightly anterior in position to the outer one. After a short interspace there is a series of 7 or 8 smaller teeth of equal size; these latter are more crowded posteriorly. The grooved fangs are slightly compressed laterally, and the groove extends very far down the tooth and is tightly closed even when quite close to the apex (Pl. XLVI. fig 20).

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[1] Boulenger ('The Fauna of British India: Reptilia and Batrachia,' London, 1890) describes these posterior maxillary teeth as being grooved. Also in P.Z.S. 1890, p. 618 ("Remarks on a Skull of *Distira cyanocincta* from Ceylon"), he mentions a large skull which possessed grooves on the mandibular teeth. There were no grooves on any of the mandibular teeth in the specimens I examined.

There is a mass of much-convoluted blood-sinuses all round both the mandibular and maxillary teeth. These attain a most astounding development in this animal, and are the most conspicuous objects present in any section (whether longitudinal or transverse) containing the teeth. They were present in the other genera examined but to a smaller degree, whereas in the four specimens of this Snake examined they were enormously developed and to the same extent on both sides of the head. These sinuses fill up the interstices between the teeth and also extend a considerable distance on both sides of the jaw; they completely surround the whole of the reserve teeth. It is impossible to consider that all this blood is required by the teeth, as many other Snakes have comparatively much larger teeth than this, yet do not possess any marked development of these sinuses. They are supplied by very large blood-vessels, and their function appears to be that of *aquatic respiration*: if so, we have to deal with accessory organs of respiration, analogous to the villous processes present in the mouths of soft-shelled Turtles (*Amyda mutica* and *Aspidonectes spirifer*[1]), and it is worthy of remark that spongy outgrowths of the mucous membrane serving a somewhat similar function occur in the Electric Eel (*Gymnotus*), but that here they may be utilized for aerial respiration by an animal whose respiration is normally aquatic[2].

EXPLANATION OF THE PLATES.

PLATE XLIV.

Fig. 1. *Dipsas fusca*: head from left side.

Note.—In all the figures of the heads the skin has been removed, the connective tissue, &c., cleared away to show the glands, and the folds of the mucous membrane of the mouth about the maxilla and mandible removed to expose the teeth; the glands, however, often lie externally to the teeth in such a manner as to hide them.

Fig. 2. *Dipsas fusca*: left maxilla from below.
3. *Dipsas ceylonensis*: left maxilla from below.
4. *Dipsas dendrophila*: ,, ,, ,,
5. *Dipsas irregularis*: Harderian gland (eye removed).
6. *Dipsas fusca*: eye removed, to show Harderian gland.
7. *Dipsas ceylonensis*: eye removed, to show Harderian gland.
8. ,, ,, : transverse section of grooved tooth.
9. *Dipsas fusca*: ,, ,, ,, ,,
10. *Dipsas dendrophila*: ,, ,, ,, ,,
11. *Dryophis prasinus*: head from left side.
12. ,, ,, : left maxilla from below.

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[1] Simon H. Gage, "Pharyngeal Respiration in the Soft-shelled Turtle," Proc. Amer. Assoc. Adv. Sci. 1884, pp. 316–318.

Simon H. & Susanna Phelps Gage, "Aquatic Respiration in Soft-shelled Turtles," Amer. Nat. vol. xx., 1886, pp. 233–236.

This accessory respiration also takes place in *Trionyx*: vide Louis Agassiz, Contrib. Nat. Hist. of the U.S.A. vol. i. (Boston, 1857), pp. 283, 284.

[2] *Cf.* Cleland, Notes on the Viscera of *Gymnotus electricus*," Memoirs and Memoranda in Anatomy, vol. i. art. ix. pp. 90, 91, pl. x. figs. 2, 3.

Fig. 13. *Dryophis mycterizans*: left maxilla from below.
14. ,, ,, : eye with Harderian gland.
15. *Dryophis prasinus*: portion of transverse section of head through the base of the grooved tooth, showing the communication between it and the duct of the poison-gland.
16. *Dryophis prasinus*: transverse section of grooved tooth.
17. ,, ,, : section of poison-gland showing three of the alveoli consisting of more or less columnar cells with large granular nuclei at their bases.
18. *Dryophis prasinus*: portion of the epithelium of the poison-duct while it is inside the gland. (The duct is more or less convoluted and the convex side of the drawing is towards the interior of the duct.)
19. *Dryophis mycterizans*: portion of the wall of the poison-duct at a point where it leaves the gland.
20. *Oxybelis fulgida*: eye with Harderian gland.
21. ,, ,, : left maxilla from below.
22. ,, ,, : transverse section through the region of the base of the first grooved tooth.
23. *Eteirodipsas colubriens*: head from the right side.
24. ,, ,, : right maxilla from below.
25. *Psammodynastes pulverulentus*: posterior portion of the right maxilla from below.

Plate XLV.

Fig. 1. *Cœlopeltis lacertina*: head from the left side.
2. ,, ,, : left maxilla from below.
3. ,, ,, : transverse section of grooved tooth.
4. ,, ,, : eye removed, to show the Harderian gland.
5. ,, ,, : transverse section through the region of the grooved tooth, showing its communication with the duct of the poison-gland.
6. *Philodryas olfersii*: head from the left side.
7. ,, ,, : left maxilla from below.
8. *Philodryas schottii*: head from the left side.
9. ,, ,, : left maxilla from below.
10. *Leptodira rufescens*: head from the left side (mandible removed)
11. ,, ,, : left maxilla from below. The positions of the reserve grooved teeth are indicated by dotted lines.
12. *Leptodira rufescens*: transverse section of grooved tooth.
13. *Leptodira annulata*: head from left side.
14. ,, ,, : left maxilla from below.
15. *Thamnodynastes nattereri*: left maxilla from below.
16. ,, ,, : transverse section of grooved tooth.
17. *Trimerorhinus rhombeatus*: head from the left side.
18. ,, ,, : left maxilla seen rather obliquely from below.
19. *Psammophis sebelans*: right maxilla from below.
20. *Homalopsis buccata*: head from right side.
21. ,, ,, : right maxilla from below.
22. ,, ,, : transverse section of one of the anterior maxillary teeth.
23. ,, ,, : transverse section of grooved tooth.
24. ,, ,, : Harderian gland (eye removed).
25. *Cerberus rhynchops*: right maxilla from below.

Plate XLVI.

Fig. 1. *Distira cyanocincta*: head from the right side.
2. *Enhydris hardwickii*: ,, ,, ,,
3. *Hydrus platurus*: ,, ,, ,, Inferior labial gland removed.

Fig. 4. *Platurus fasciatus*: head from the right side.
5. „ „ : Longitudinal section of the head taken through the poison-gland and duct.
6. *Hydrus platurus*, var. *alternans*: left poison-gland and duct from side.
7. „ „ „ „ „ „ „ „ above.
8. *Distira cyanocincta*: right maxilla from below.
9. *Enhydris hardwickii*: „ „ „ „
10. *Hydrus platurus*: „ „ „ „
11. *Platurus fasciatus*: „ „ „ below.
12. „ „ „ „ „ side.
13. „ „ : longitudinal section through the base of the external poison-fang, showing the enlargement of the duct (*d.*) to form the vertical cavity (*e.d.*); the muscular mass (*m.*) is situated directly in front of the base of the tooth (*vide* fig. 14, *m.*), and the communication between this cavity and the groove of the tooth is not shown.
14. *Enhydris hardwickii*: transverse section through the bases of the poison-fangs, showing the communication between the enlarged extremity of the duct and the groove of the more internally situated tooth.
15. *Distira cyanocincta*: transverse section of the poison-gland and the superior labial gland taken at a point about through the middle of the eye, the former is gradually passing into the duct and the latter is increasing in size anteriorly. The artery (*a.*) and vein (*v.*) are the afferent and efferent blood-vessels of the large blood-sinuses surrounding the maxillary teeth.
16. *Hydrus platurus*, var. *alternans*: Harderian gland and eye.
17. *Distira cyanocincta*: Harderian gland and eye.
18. *Platurus fasciatus*: „ „ „
19. *Enhydris hardwickii*: Harderian gland (eye removed).
20. *Hydrus platurus*: transverse section of poison-tooth.
21. *Platurus fasciatus*: transverse section of poison-tooth.
22. *Enhydris hardwickii*: „ „ „ „

a.	Artery.
av.	Alveoli of gland.
c.t.	Connective tissue (interstitial).
d.	Duct of poison-gland.
d.s.l.	One of the ducts of superior labial gland.
e.d.	Enlarged distal end of the duct of the poison-gland.
ep.	Epithelial cells of duct.
ep.gl.	Glandular (?) epithelial cells of duct.
gl.i.l.	Inferior labial gland.
gl.s.l.	Superior labial gland.
gr.	Groove of poison-fang.
H.gl.	Harderian gland.
m.	Muscular pad in front of the base of poison-fang.
mx.	Maxilla.
p.	Poison-tooth (functional).
p.r.	Poison-tooth (reserve).
p.c.	Pulp-cavity.
p.gl.	Poison-gland.
t.	Transpalatine.
v.	Vein.

December 3, 1895.

Sir W. H. Flower, K.C.B., LL.D., F.R.S., President,
in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the months of October and November 1895:—

The total number of registered additions to the Society's Menagerie during the month of October was 112, of which 63 were by presentation, 24 by purchase, 1 by exchange, 2 were born in the Gardens, and 22 were received on deposit. The total number of departures during the same period, by death and removals, was 146.

The registered additions to the Society's Menagerie during the month of November were 80 in number. Of these 41 were acquired by presentation, 30 by purchase, 2 were born in the Gardens, and 7 were received on deposit. The total number of departures during the same period, by death and removals, was 83.

Amongst the additions, attention was called to the acquisition of a male specimen of the supposed new Wild Goat of the island of Giura, one of the Sporades, which had lately been described by Dr. Reichenow of Berlin (Zool. Jahrb. vol. iii. p. 598, 1888) as a distinct species, under the name *Capra dorcas*.

A communication was read from Dr. G. Stewardson Brady, F.R.S., containing a Supplementary Report on the Crustaceans of the group Myodocopa obtained during the 'Challenger' Expedition. To this were added notes on other new or imperfectly known species of the same group.

This paper will be published entire in the Society's 'Transactions.'

The following papers were read:—

1. On some Points in the Anatomy of *Pipa americana*. By Frank E. Beddard, M.A., F.R.S., Prosector to the Society, Examiner in Zoology to the University of London.

[Received October 1, 1895.]

Through the kindness of Mr. Clarence Bartlett, I have been able to dissect two specimens of the Surinam Toad (*Pipa americana*) which had been forwarded to him in spirit from British Guiana. They proved to be in an excellent condition for dissection. So far as I am acquainted with the literature relating to this Amphibian, there has been but one general account of the anatomy of the soft parts since the year 1825, when it was studied by Mayer[1], who did not, however, direct attention to the special matters upon which I desire to report in the present communication. Mayer dissected three individuals, and he remarked upon the fact that in all of them the alimentary canal for the greater part of the intestinal region was beset with numerous small spherical cysts, which were mistaken by his predecessor Fermin for glands appended to the alimentary tract, but which were recognized by Rudolphi as encysted Nematodes. There is no doubt about this identification, and I found them present in large numbers in both my specimens. It is remarkable to find a parasite so invariably and so numerously present in its host, though there are other similar instances, such as the Gregarines in the sperm-sacs of the common Earthworm. Mayer's paper deals not only with the abdominal viscera, but also with the skeletal and muscular systems. There is, however, an earlier paper[2] which is not without value; in the plates appended to this are illustrations of several of the viscera isolated from their surroundings. More recently Klinckowström and Grönberg[3] have described and figured the structure of the skin, the larynx, the blood-vessels and the brain, besides some of the other viscera more or less incidentally.

The two main lobes of the liver[4] are absolutely separated from each other, the entire chamber enclosed by the suspensory ligaments of the anterior abdominal veins intervening. Along one margin each of the two lobes is firmly attached to the suspensory ligament of the abdominal vein, to the "diaphragm" and to the lung. The left half of the liver is rather larger than the right, and is partly divided into two lobes. The globular gall-bladder is associated with the right half of the liver; it is partly covered over by it, and lies in close contact with the membrane supporting the anterior abdominal vein.

The anterior abdominal vein, instead of being firmly attached to the ventral parietes, is borne at the angle of a membrane which is V-shaped in transverse section. This membrane, however, in the hinder part of the body-cavity at any rate, seems to be merely the slightly displaced peritoneum, which in that region of the body is not closely adherent to the muscular parietes. On pulling the vein the whole of the peritoneum lining the body-cavity posteriorly readily came away. Anteriorly the state of affairs seems to be a little different. The abdominal vein is still supported by a V-shaped membrane, but the two folds of membrane are firmly attached to the parietes. So far my description applies to the female example of the frog dissected by me. In the male the abdominal vein appeared posteriorly to stand out freely from the body-wall. I could find no trace of any membrane until about halfway between the end of the abdominal cavity and the edge of the sternum.

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[1] "Beiträge zu einer anatomische Monographie der *Rana pipa*," Verh. k. Leop.-Car. Akad. 1825, p. 527.

[2] Breyer, 'Observationes Anatomicæ circa fabricam *Ranæ pipæ*' (Berl., 1811).

[3] "Zur Anatomie der *Pipa americana*," Zool. Jahrb. Abth. f. Anat. 1894.

[4] There is a small separate third lobe. See Zool. Jahrb. *loc. cit.* pl. 39. fig. 7.

At this point where the membrane began the vein bifurcates. In the female frog the bifurcation of the abdominal vein coincides with the commencement of the fixed attachment of the mesenteries already spoken of. In the anterior part of the abdominal region there is thus a tent-like cavity which might be mistaken—particularly in the male, where it ends abruptly posteriorly—for a pericardium. In this cavity lies the heart, with its closely adherent pericardium. The abdominal vein lies inside the "tent," being here and there only loosely fastened to its walls. Where the abdominal vein bifurcates, which it does quite half an inch behind the edge of the liver, the cavity of the tent increases in depth vertically and its roof becomes attached to the stomach and commencing intestine, forming the ventral mesentery of the same.

This cavity is an exaggeration of a corresponding arrangement in the frog.

§ *The Diaphragm.*

I have already made use of the word "diaphragm" in describing the attachment of the liver. The liver is attached anteriorly on both sides of the body to a membranous wall which is continuous with the suspensory ligament of the abdominal veins and appears to limit the body-cavity anteriorly. To this is also attached the lung, and on the left side of the body in both sexes a deep pocket is formed behind the lung owing to the angle at which the two membranes join. This is slightly marked on the right side. Where the transverse vertical dissepiment is cut through it is seen not to mark the anterior boundary of the body-cavity. In front of it lie two cavities of considerable size, separated from each other by another vertical septum and from their fellows by the œsophagus. These cavities are suggestive of the water-tight compartments of a man-of-war. Whether they are true cœlom or not I am unable to say.

The septum to which the lung and the liver are attached is continuous with what I presume to be the dorsal peritoneum, or at least a portion of it. This membrane is tough and strong, and can readily be raised from the parietes. Anteriorly it is perforated by the two halves of the dorsal aorta, which lie perfectly freely in the space between the membrane and the parietes, being quite unattached to either. The anterior half of the cavity thus exposed by raising the tough peritoneal membrane is not floored (or rather roofed) by the muscles; these are covered by [1] a delicate semitransparent membrane in which run blood-vessels &c. From about the region where the two aortæ join, at the anterior end of the kidneys, there appeared to be no layer covering the muscles other than the first-described membrane.

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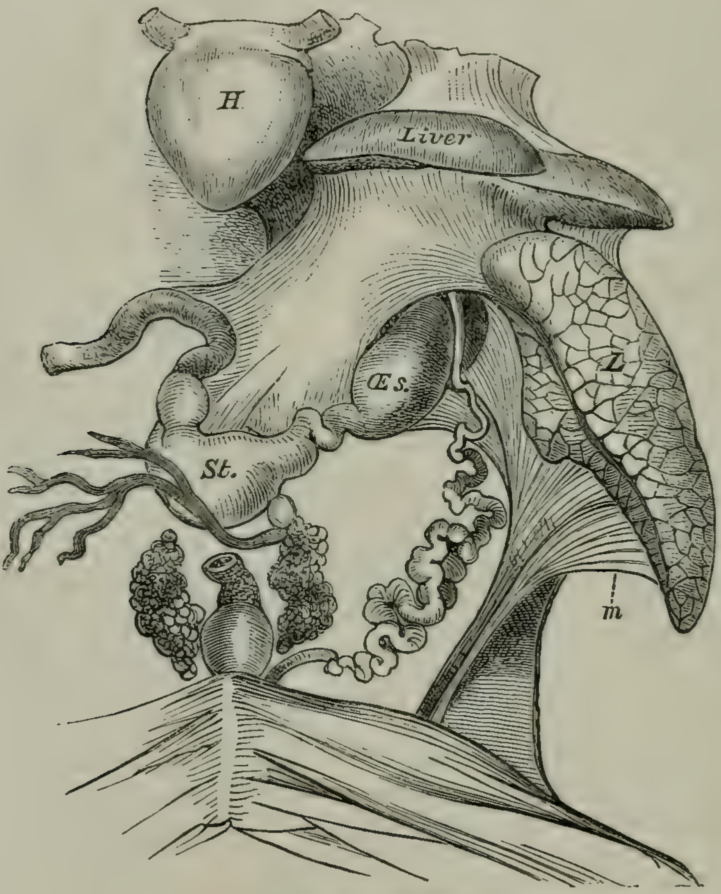
[1] It is possibly comparable to what Mr. G. W. Butler has described (P. Z. S. 1889, p. 445) in the Bird. Development appears to show that the oblique septum in the Fowl is one structure with the aponeurosis covering the lungs, it having been blown away from it, to use Mr. Butler's phraseology, by the intermediate air-sacs. But septa remain connecting the two layers and separating the air-sacs. So, in *Pipa*, the peritoneum lying immediately behind the lung is separated by an interval from the peritoneum covering the muscles of the parietes, and *anteriorly there is a vertical transverse septum* joining them.

The accompanying drawing (fig. 1) illustrates the lungs and the diaphragmatic membrane as seen from the interior of the body. It will be observed that the lung is bifid and that it is firmly attached to the membrane except in two regions; the smaller lobe is not so attached, and the main lobe is free for about the last three quarters of an inch of its length. The drawing will also partly explain why I have used the expression "diaphragm" in describing the strong sheet of peritoneum which is so readily detachable from the parietes. It will be noticed that narrow

Fig. 1.



Pipa surinamensis.

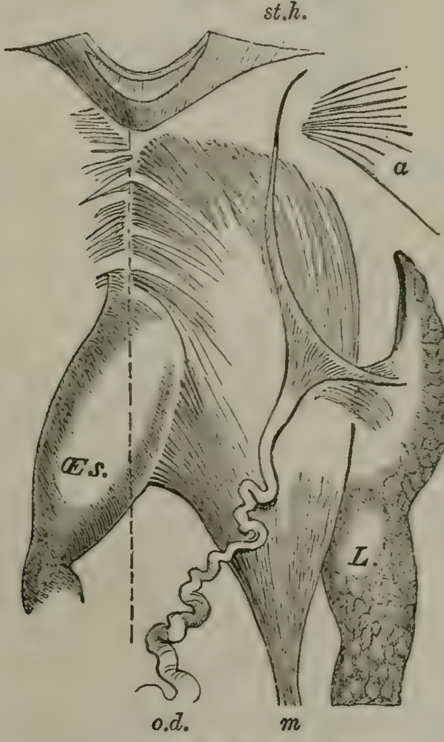
General view of abdominal viscera.

H., heart; *L*, lung; *Œs.*, œsophagus; *St.*, stomach; *m*, musculus pulmonum proprius.

muscle arises from the thigh close to the *rectus femoris*[1]. This runs forward, increasing in breadth and undergoing a corresponding diminution in thickness; ultimately it fans out over the back of the lung and of the œsophagus; it begins to be attached to the lung first at the origin of the smaller lobe of that viscus. I cannot but think that the close attachment of the muscle to the lung must have some relation to the function of respiration.

The main mass of the muscles, however, go past the lung, and are, as already stated, inserted upon the œsophagus. At their insertion, which is on the median ventral side, they not only fan out, but the muscle becomes separated into a number of small separate bundles. The corresponding muscle of the opposite side of the body has to perforate the mesentery on its way to be inserted on to the œsophagus. All the fibres of the muscle are not, however, inserted in this way on to the œsophagus; a good number of them fan out dorsally and are inserted on to the aponeurosis already spoken of, which shuts off the abdominal cavity in front. The arrangement of these fibres is shown in the accompanying drawing (fig. 2).

Fig. 2.



Pipa surinamensis.

Dissection to display diaphragm.

o.d., oviduct; *a*, branch of obliquus muscle; *st.h.*, sternohyoid. Other letters as in fig. 1.

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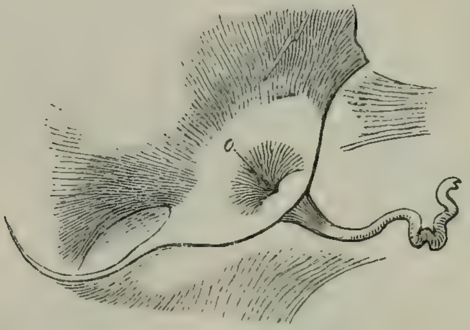
[1] See p. 839.

In that drawing will be observed another muscle descending, in the position in which the animal is represented, from the ventral body-wall. This muscle is a portion of the sternohyoid, which leaves the anterior larger portion and is inserted just on to the posterior edge of the expanded hyoid cartilage and on to the aponeurosis, with which the hyoid cartilage is also in contact. A third muscular slip (fig. 2) from the obliquus also fans out over the diaphragm.

Fig. 3.



Pipa surinamensis.

Dissection to illustrate internal aperture of oviduct (*o*) borne upon a special membrane shown also in fig. 2.

I am not, however, directing attention for the first time to this curious structural peculiarity of *Pipa*. Breyer, in his memoir upon the anatomy of the frog, figures the lungs and the muscle attached to them, which he describes in the following words:—

"Tunicæ nimirum externæ [musculus] ab hepate oriundus additur, et musculorum adjacentium fibræ simul accedunt; sine pulmonis saltem dilaceratione, lacerti musculosi eidem affixi separari nequeunt."[1]

Physiologically, this fan-shaped muscle which spreads out over the back of the lungs in *Pipa* seems to be comparable to the muscles which arise from the ribs and spread out over the lungs in birds, and which Huxley regarded[2] as being collectively, and possibly, the homologue of the Mammalian diaphragm. Morphologically, comparisons are more difficult. Its insertion on to the stomach reminds us of Prof. Huxley's description[1] of a muscle in the Crocodile which "arises on each side from the anterior margin of the pubis; and its fibres pass forward, diverging as they go, to be inserted into the ventral face of the posterior part of the pericardium and into the ventral and lateral parts of the fibrous capsule of the stomach."

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[1] Mayer gives a different account of the origin of this muscle. "Am merkwürdigsten von allen Muskeln ist aber der diesem Thiere eigenthümliche Lungenmuskel, *musc. pulmonum proprius.* Er entspringt, $1\frac{1}{2}$ Linien breit und $\frac{1}{2}$ Linie dick, von dem Darmbeinkamm unterhalb des *musc. latissimus dorsi,* geht nach auf- und einwärts, heftet sich an die hintere Fläche des untern Sackes der Lunge seiner Seite an, und verbreitet sich mit dicken strahlenförmig auseinanderfahrenden Fasern an dieser hinteren Wandung der Lunge." But on a previous page he speaks of a separate muscle running to the pharynx. This *musculus abdominis posterior* "entspringt ebenfalls von dem Femur, aber an seinem äussern Winkel ist schmal, jedoch dick, tritt unter den *latissimus dorsi* in die Bauchhöhle hinein und erstreckt sich .... nach aufwärts, indem seine Muskelnfasern an der vordern und hintern Fläche des Pharynx sich verbreiten."

[2] "On the Respiratory Organs of *Apteryx*," P. Z. S. 1882, p. 560.

More important is the comparison with the frog, in which there is a muscle embracing the œsophagus, the so-called diaphragm. This is figured by Howes in the 'Atlas of Biology,' and described by Ecker as a part of the conjoined *obliquus internus transversus*; it arises, however, from the transverse process of the anterior vertebræ, but may still represent the anterior portion of the muscle described and figured here in *Pipa*. It is, however, perhaps more likely that the diaphragm of *Rana* is represented by the termination of the obliquus internus lettered *a* in my diagram (woodcut, fig. 2) of *Pipa*. If it be possible to compare the rudimentary diaphragm of *Rana* with that of the Mammalia, it seems even more possible in the case of *Pipa*. For in *Pipa* the diaphragm is formed by a dorsal and ventral set of muscles; there is a complete ring of muscles as in the Mammal.

The female frog which I dissected bore a number of young upon her back. I examined one of these, a fully-formed frog of about half an inch in length, in order to ascertain how far the various structures described above were visible. The anterior end of the young frog was cut into a series of longitudinal sections. I found that the lungs hung freely in the body-cavity after their emergence from the thoracic region; there was no trace whatsoever of any muscular or other attachment to the parietes. On the other hand, that section of the diaphragm which I have described above as shutting off the heart and pericardium from the abdominal cavity was present. So far, therefore, as one is at liberty to draw inferences from the order of development of various structures, the muscular fascia which spreads out over the lungs is a newer structure and perhaps conditioned by the special needs of *Pipa*, which is, as is well known, more purely aquatic in its habits than are many other Anurous Amphibia.

§ *Myology.*

The muscular anatomy of this Amphibian has been to some extent described by Mayer with an illustrative figure. I have endeavoured to supplement his account with some additional details. The animal was dissected side by side with an example of the large *Rana guppyi* from the Solomon Islands, which agrees in its myology with *Rana esculenta*, excepting in some small particulars noted in the course of the following description. The English translation by Haslam of Ecker's 'Anatomy of the Frog' has been my guide in comparing the muscles of the two animals, which show a number of divergences other than those indicated by Mayer.

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[1] Ibid. p. 568.

Muscles of the Head, Trunk, and Fore-limb.

The *obliquus externus* was, as Meckel has pointed out, overlooked by Mayer, who, however, curiously enough, figures it. It is only found in the posterior region of the abdomen, where it covers the pectoral and arises from the symphysis pubis and also from the rhomboidal area, mentioned in connection with the abdominal portion of the pectoral.

The *Rectus abdominis* is in three portions; one arises from nearly the entire length of the femur, and has been confounded by Mayer with the abdominal portion of the pectoral. As a matter of fact, it ends in a transverse band of tendon (a tendinous inscription), from which the pectoral arises. Another small portion runs from the symphysis pubis to the rhomboidal tendon already mentioned. The third portion is deep of the others, and passes forward on each side to the edge of the sternum.

The *obliquus internus* is a well-developed muscle which has an antero-posterior direction.

The *depressor mandibulæ* differs from that of *Rana* in that it arises from the skull itself and not from any fascia.

The *cucullaris* is an oblong muscle (it is triangular in *Rana guppyi*); at its insertion it overlaps the last muscle instead of being overlapped by it as in *Rana*.

The *latissimus dorsi* has a very remarkable arrangement, which differs greatly from that of *Rana guppyi*; in the latter it is a long triangular muscle which arises from the middle line of the back and runs nearly parallel with and over the hinder half of the *infraspinatus* to be inserted in common with it on the humerus. In *Pipa* the function of the *latissimus dorsi* is largely assumed by what I take to be the homologue of a portion at least of the *obliquus externus*. The latter is a fan-shaped muscle corresponding in shape and extent to the abdominal portion of the pectoral on the ventral side of the body. The muscle arises partly from the fascia covering the lateral abdominal region and partly from the great long transverse processes of the sacral vertebræ. It narrows to be inserted on to the humerus in common with the infraspinatus and partly on to lower border of scapula. Where it passes under the scapula it is joined by a delicate muscle consisting of a few widely separated fibres lying in the fascia covering the scapula. This I take to be the much-degenerated representative of the *latissimus dorsi* of *Rana*. It does not, however, blend with the fibres of the external oblique, but ends at right angles to them. It will be noticed, however, that the pull upon the forearm, which is the resultant of these two muscles, would not be widely different in direction from that exercised by the single *latissimum* of *Rana*. This, at any rate, might well be the case were the muscles equal in strength. I believe, however, that the decay of the *latissimus dorsi* bears some relation to the different movements of the forearm required by so purely swimming a creature as *Pipa*, its place having been gradually taken by another muscle more fitted by its place of origin to bring about those movements.

A remarkable resemblance between *Pipa* and *Dactylethra* is afforded by the peculiar arrangement of the *latissimus dorsi* muscle in the two genera. Dr. Maurer[1] has described and figured in *Dactylethra* an "abdominal" portion of the *latissimus* which is quite as extensive as in *Pipa*. From the figure (fig. 10) which illustrates this I infer that the transversely running part of the muscle is also present. It is possible, of course, that the resemblance is one due to a similar environment, for *Dactylethra* is quite as aquatic in its habits as is *Pipa*. On the other hand, there is some evidence that the likeness is one indicating a deeper-lying affinity; for Maurer points out that in *Ceratophrys* the abdominal portion of the pectoral is feebly developed, while in *Dactylethra* it is large as in *Pipa*; in both of these genera the fore-limbs are largely used, and the fore-limb of *Ceratophrys* is much stouter than that of *Dactylethra*; so that on *a priori* grounds it might be expected that the pectoral of the former would be larger.

The same kind of argument might apply to the *latissimus*, which is the antithetical muscle to the pectoral. There are therefore some grounds for believing that the resemblance between *Pipa* and *Dactylethra* in this matter are resemblances of genetic importance. The great extent of this muscle in these two genera of Anurous Amphibians is suggestive of the Mammal to which it has been said that the myology of the Anura bears more resemblance than the Urodela.

The *rhomboideus* (or *retrahens scapulæ*), which in *Rana guppyi* arises almost entirely from the spines of the vertebræ—a small portion only springing posteriorly from the tendinous inscription of the *extensor dorsi communis*—and not from the transverse processes as in *Rana esculenta*, is totally absent in *Pipa*. To the under surface of the scapula are attached three muscles, which Ecker terms the *transversi scapulares*; they are all three present in *Pipa*.

So, too, are the *levator anguli scapulæ*, the *sternocleido-mastoid*, and the *protrahens scapulæ*, which attach the scapula to the head.

The *infraspinatus* arises, as in the frog, from a large portion of the dorsal surface of the scapula; a few fibres, however, take their origin from the fascia which lies between the scapula and the head. In the frog a straight line ruled across the scapula would indicate the sharply marked anterior boundary of the origin of the muscle. In *Pipa* the corresponding line is V-shaped, the muscle being really in two parts. The anterior half of the muscle, which extends further beyond the edge of the scapula than in *Rana*, crosses over the posterior portion near to the insertion and narrows rapidly to a thin tendon which is inserted in a line with, but independently of and anterior to[1] the insertion of the lateral half of the muscle. The posterior half of the muscle is the larger; it ends in a flat, widish tendon, which is joined behind by the tendon of the *latissimus dorsi*. Neither part of the muscle has any relation to the deltoid, such as is the case with *Rana guppyi*; in that frog the tendon becomes adherent to the tendinous sheath of the deltoid before its own insertion.

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[1] "Die ventrale Rumpfmuskulatur der anuren Amphibien," Morph. Jahrb. 1895.

There is a small *submentalis*.

The *submaxillaris* (*mylohyoid*) is divided into two portions, as it is in the Common Frog. The anterior, much the larger, portion runs across the floor of the mouth in the usual way, while the small posterior portion arises from the hyoid. The main part of the muscle arises by six separate digitations from the mandibular margin, as described by Mayer, who gave it on this account the title of "*musculus hexagastricus*."

Pectoro-mandibulæ. Beneath the last-mentioned muscle is a sheet of muscular fibres which is totally unrepresented in the Common Frog and which has a very peculiar distribution. The muscle appears to correspond to Mayer's "*pectoralis superior*," but is not fully described or figured by him. The muscle is inserted along the entire length of the mandibles. It arises from the fascia covering over the sternal region of the pectoral muscles, and completely covers those muscles itself. At one corner it is inserted on to the humerus in common with the pectorals. They may possibly correspond to the *cutaneus pectoris* of the frog and to the *panniculus carnosus* of mammals.

The *sternoradialis* is very much larger in proportion in *Pipa* than it is in *Rana*. It is at least four times as large as either of the sternal portions of the pectoral, and is indistinctly divisible into three masses. Its tendon, passing to forearm, does not run between the divisions of *pectoralis* as in *Rana*.

The *pectoralis* consists of three parts, or, if we include the *pectoro-mandibular* described above, four separate portions. (1) The abdominal portion is of considerable extent, and the two muscles are separated anteriorly by a fascia continuous with them, which ends anteriorly in a free edge lying on the sternum. Posteriorly the fibres originate from a rhomboidal plate of tendon figured by Mayer, which lies medianly and posteriorly from tendinous intersection with *rectus abdominis*. (2) The anterior sternal portion is superficial to the *sternoradialis*; it arises by a thin flat tendon from the middle line of the sternum. (3) The posterior sternal portion is in contact with the *sternoradialis* for its whole length.

The *coraco-humeralis* is well developed.

The *deltoid* of *Rana guppyi* does not correspond with Ecker's description of that muscle in *Rana esculenta*. The scapular and clavicular heads are the same, but there is, in addition, a third head which ought perhaps to be regarded as a distinct muscle.

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[1] *i. e.* nearest to the hand.

It is triangular in form and arises from the clavicle up to about halfway up, and from the base of the scapula anterior to the attachment of the clavicle. The fibres converge to an insertion upon the humerus nearer to the shoulder-blade than that of the *deltoid*. In *Pipa* the smaller head of the *deltoid* only arises from the clavicle and does not reach the omosternum; it may therefore rather correspond to the muscle just described in *R. guppyi* than to the clavicular head of the *deltoid* of that frog and of *Rana esculenta*.

Pectoralis minor. This muscle, to which I provisionally give the above name, is another muscle which is apparently absent from the shoulder of *Rana esculenta*, as I can find no description of it in Ecker. But it is present in *Rana guppyi*. It arises from the coracoid, but from the lower part, not from the upper part where the *coraco-humeralis* takes origin. It is, indeed, rather related to the *subscapularis* running parallel with that muscle, and indeed partly covered by it for nearly the whole of its course, but everywhere separable from it. It is a fleshy muscle with fleshy origin and insertion. At the insertion it bifurcates and is attached to the humerus on either side of the tendon of insertion of the posterior sternal portion of the *pectoral*.

I find this muscle in *Pipa*, where, however, it is quite insignificant compared with the large muscle of *Rana guppyi*; it arises from the lower portion of the coracoid, and is hardly distinguishable either at its origin or insertion from the *coraco-humeralis*, except that it is entirely fleshy, while the *coraco-humeralis* is inserted by a strong tendon.

Muscles of the Leg.

When the muscles of the thigh are exposed to view by removing the skin, five muscles are visible on the ventral surface in *Rana*. *R. guppyi* is precisely like *R. temporaria*. These muscles are, commencing with the anterior border of the thigh, *vastus internus*, *sartorius*, *adductor magnus*, *rectus internus major*, and *r. i. minor*. In a similar preparation of the corresponding region of *Pipa* it is necessary, in order fully to display the muscles, to cut away the origin of the *rectus abdominis*; for this muscle in *Pipa* arises from nearly the entire length of the femur, and naturally, therefore, entirely hides the *vastus internus*. When this dissection is effected no less than seven muscles are visible, six of them for nearly the whole of their course, as shown in the accompanying drawing (fig. 4).

But a very important muscle of the thigh of *Rana* is totally wanting in *Pipa*—that is, the *sartorius*; I could find no trace of this muscle[1], the absence of which is possibly to be accounted for by the physical impossibilities introduced by the attachment to the femur of the abdominal musculature.

The *adductor magnus* is more completely divisible into two parts than it is in *Rana*. In *Rana* the muscle is, as it were, split, near to the origin, for the emergence of the anterior half of the double-headed *semitendinosus*. In *Pipa* the *adductor* in question arises by two distinctly separate heads of origin; the two bellies do not unite even at their attachment, where, however, they are naturally contiguous, though not in any way fused to form a common insertion. The anterior part of the muscle arises by a flat tendon of considerable length; the second part of the muscle lies below and behind the first; it has a completely fleshy origin; it is chiefly hidden on a superficial view by the anterior part of the *semitendinosus*. The first part of the muscle is attached only to the

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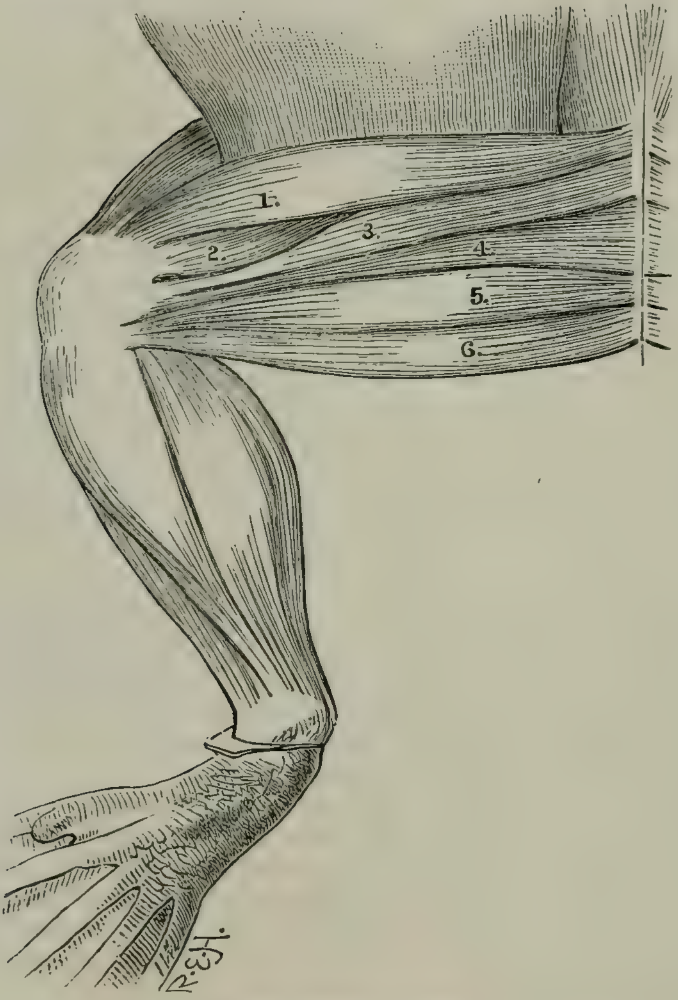
[1] Mayer calls "*sartorius*" what I term *semitendinosus* (anterior head).

Fig. 4.



Thigh-muscles of *Pipa*.

1, adductor magnus; 2, semimembranosus; 3, 4, semitendinosus; 5, 6, recti interni.

inner and under surface of the extremity of the femur; the second half has a more extensive insertion on to about the last half of the femur.

The *adductor longus* is perfectly distinct from the foregoing, Its attachment is to the proximal part of the femur, and ends not long after the commencement of the attachment of the *adductor magnus.*

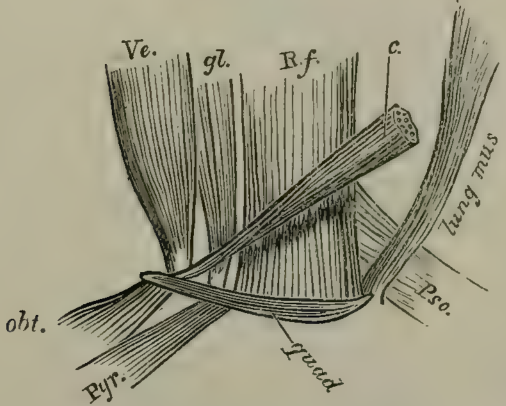
The *adductor brevis* has an attachment to the femur, which is not so long as that of the last-described muscle.

The *semitendinosus* has two distinct heads, which, however, lie side by side, and are quite superficial in origin. They become fused about two-thirds of the way between the origin and insertion; a little after this they dip under the *recti interni*, and are inserted on to the fascia of the knee by a strong narrow tendon.

The two *recti interni* are subequal in size.

The *rectus femoris* group consists, as in the frog, of three muscles; but the middle muscle of the "triceps," the *rectus anticus femoris*, differs entirely from that of *Rana*. It is a thin and broad sheet of muscle, which arises entirely from the wide plate of bone which is formed by the transverse process of the sacral vertebra, and passes straight downwards parallel with the *glutæus* to be inserted directly on to the proximal portion of the femur; it does not fuse with either of the *vasti*, which are both present and normal. At its insertion (see fig. 5) it is in contact with the long muscle already described as running to the lung.

Fig. 5.



Some of the thigh-muscles of *Pipa*.

Ve., vastus externus; *gl.*, glutæus; *R.f.*, rectus femoris; *quad.*, quadratus; *Pso.*, psoas; *c.*, biceps; *lung mus.*, musculus pulmonum proprius; *Pyr.*, pyriformis; *obt.*, obturator.

The *biceps* is a slender muscle arising just below the *vastus externus*; it ends by a long thin tendon upon the head of the tibia, The *quadratus femoris* is a small slender muscle, covered by the *biceps*, exactly beneath which it lies.

The accompanying drawing (fig. 5) of the muscles visible in a dissection of the outer side of the thigh shows two which I identify with the *pyriformis* and *obdurator* respectively.

The *semimembranosus* is a very stout muscle.

The *psoas* is also well developed.

I could not find a *pectineus*, unless what I have called the *adductor brevis* be really that muscle? But I do not think, after a comparison with *Rana guppyi*, that I have made this mistake. The *gastrocnemius* is a very stout muscle, which arises by a short strong tendon from the femur only. At the ankle it passes into the strong sesamoid bone, well known in the Common Frog; perfectly continuous with the latter is a flat strap-shaped tendon, which immediately divides into two divergent tendons, which go to be inserted upon two cartilages which are attached below the heads of the first and fifth metatarsals respectively. The two tendons are united for their whole length by a thin tough fascia. The two tendons and the uniting fascia apparently correspond to the plantar fascia of the frog. But in *Rana guppyi*, at any rate, the fascia is evenly stout throughout, and does not strip off in the same way because muscles are attached to it.

The *tibialis posticus* does not differ in essentials from Ecker's account of that muscle in the Common Frog; but neither in *Pipa* nor in *Rana guppyi* does the origin of the muscle extend along the whole length of the tibia; there is a considerable area at the upper end free from it.

The *tibialis anticus* also needs no comment, save that the division into two bellies is higher up the leg than in *Rana guppyi*.

The *peroneus* is well developed.

So also is the *extensor cruris*; both these muscles are much as in *Rana*.

The *flexor tarsi anterior* consists in *Pipa* of a stoutish muscle, which arises from about the middle of the tibia.

The *flexor tarsi posterior* has no extensor of the middle toe attached to it as in *Rana*.

§ *Summary of the principal Differences in the Musculature of* Pipa *and* Rana.

The following muscles, which are present in *Pipa*, are wanting in *Rana*:—(1) *Pectoro-mandibular*. (2) Abdominal portion of *latissimus dorsi*. (3) *Pulmono-œsophageal*.

The following muscles, which are present in *Rana*, are wanting in *Pipa*:—(1) *Rhomboideus*. (2) *Omohyoid*. (3) *Pectoro-cutaneus*. (4) *Sartorius*. (5) *Pectineus*. (6) Branch of posterior *extensor tarsi* to third toe.

Other points of difference are:—

(1) Origin of *depressor mandibular* from skull-wall in *Pipa* instead of from fascia covering neck. (2) Small size of clavicular

portion of *deltoid* in *Pipa*. (3) Double nature of *infraspinatus* in *Pipa*. (4) Separate attachment of middle portion of *triceps femoris* to thigh in *Pipa*. (5) Origin of abdominal muscles from thigh in *Pipa*, instead from pubis as in *Rana*.

In addition, a number of smaller differences will be apparent from a consideration of the foregoing account of the myology of *Pipa surinamensis*.

2. On the Diaphragm and on the Muscular Anatomy of *Xenopus*, with Remarks on its Affinities. By Frank E. Beddard, M.A., F.R.S., Prosector to the Society, Examiner in Zoology to the University of London.

[Received October 31, 1895.]

Having dissected and described[1]—I believe with greater detail than had been done previously—the "diaphragm," as well as the muscular anatomy generally, of the Surinam Toad (*Pipa*), I was anxious to see how far there was a resemblance with the African genus *Xenopus* (*Dactylethra*); for in spite of their wide separation in space and divergent external characteristics, many naturalists hold that these two genera are closely related, to which opinion expression has been given by placing them in one division of the Anura—the Aglossa. The opportunity of making the requisite dissections has been afforded by the death of a female specimen, presented to the Society a year or two since by Mr. F. Finn, F.Z.S., which was brought to me directly after death, and was therefore in good condition.

§ *The Diaphragm.*

Before proceeding to record the presence of various bands of muscle which I believe correspond to the complicated diaphragm of *Pipa*, I shall direct attention to certain of the viscera in the neighbourhood. The lung itself is in some respects intermediate between that of *Rana* and that of *Pipa*, as regards its fixation to the body-wall. In *Rana* the lungs lie entirely free in the cœlom with the exception of their roots. In *Pipa*, on the other hand, a considerable length of the lung is firmly attached to the body-wall. *Xenopus* stands midway between these two extremes; a fold of peritoneum of about half an inch in length ties the lung to the body-wall. There is also a pulmono-gastric attachment. Beneath the lung is a deepish pocket whose right and left walls are formed by these two mesenteries; within this lies the terminal section and internal orifice of the oviduct. This aperture, it will be noticed from the figure (fig. 2), lies to the inner side of the lung; in *Pipa* the aperture of the oviduct lies quite to the side (inner) of the lung, and is borne upon a special fold of peritoneum, which I have illustrated in my account of the anatomy of that batrachian. In *Rana*, on the other hand, the oviduct crosses the base of lung behind it and then curves back on the anterior face of the lung, where it opens. The various membranes which in *Xenopus* connect together the lung with the oviduct, and the lung with the stomach, and each of them with the parietes, form a closed sac lying beneath the stomach. The proximal section of the oviduct lies on the outer wall of this sac. As in *Pipa*, the heart and pericardium are enclosed in a membranous sac.

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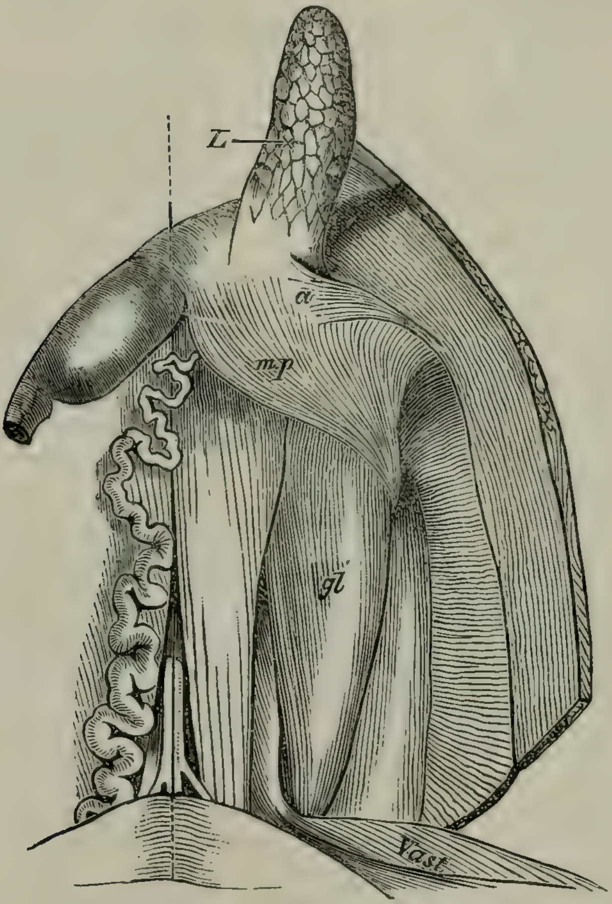
[1] "On some Points in the Anatomy of *Pipa americana*," above, p. 827.

We now come to the diaphragm, by which I understand the muscles which are particularly related to the lung and œsophagus.

Fig. 1.



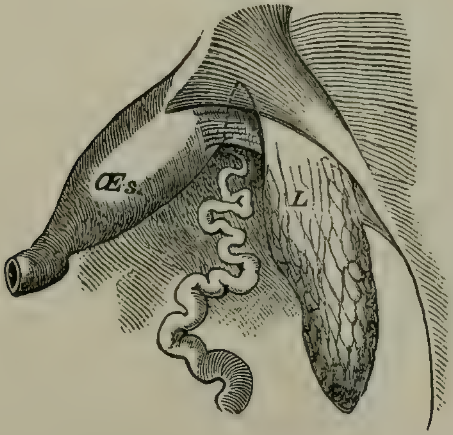
Interior of abdominal cavity of *Xenopus*.

L, lung; *m.p*, musculus pulmonum proprius; *a*, branch of obliquus internus; *gl*, glutæus.

The muscular fibres are, as in *Pipa*, derived from three sources:—(1) There is first of all a special muscle whose main concern is with the lungs and œsophagus. This is, I believe, not merely the analogue, but the homologue of the "*musculus pulmonum proprius*," as Mayer termed the muscle which I have illustrated in figs. 1 and

2 of my paper upon *Pipa*[1]. But it has a different origin. The accompanying drawing (fig. 1) illustrates the muscle in question with various adjacent structures. *gl.* is a large muscle which I describe later as the "*glutæus*," though it may represent the *glutæus* and a *psoas magnus*—the "*psoas*" of my subsequent description (not visible in the present drawing) being in that case a *psoas minor.* Not far from the anterior end of this *glutæus* there arises between its two heads (dorsal and ventral) a stoutish flat muscle (*m.p.*) of a coarse texture from the edge of the ilium. I was at first disposed to suspect that this muscle dipping down between the two, thus separating portions of the *glutæus*, might run parallel with them, but hidden from sight, to be inserted on to the femur. But a careful dissection showed that this was not the case. Some of the fibres of this muscle are attached to the lung in front, others passing round behind it; others again accompanying these, pass round behind the lung and traversing the ligamentum latum are inserted upon the œsophagus (woodcut fig. 2). The main mass of the muscle, however, traverses the floor of the chamber already spoken of as underlying the stomach, and is inserted on to the œsophagus and on to a fibrous aponeurosis lying behind the lung.

Fig. 2.



Lung, œsophagus, and related musculature in *Xenopus*.

L, lung; *Œs.*, œsophagus.

(2) The *obliquus internus*, as in *Rana* and in *Pipa* (see above, p. 831, fig. 2), enters into the formation of the diaphragm; a few muscular slips (fig. 1, *a*) are given off, which are attached to the base of the lung, traversing the mesentery already spoken of which connects the lung with the parietes. A large portion of the muscle,

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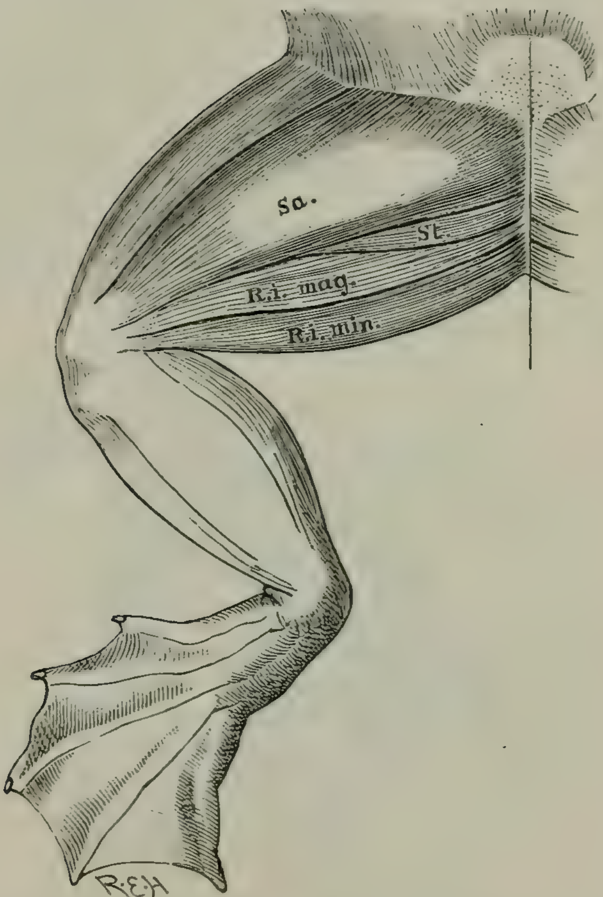
[1] *Loc. cit.*

moreover, ends on the fibrous aponeurosis already spoken of as lying behind the lung.

(3) As in *Rana* and *Pipa*, the sterno-hyoid muscle bifurcates below the sternum into an anterior and posterior section. In *Xenopus* the posterior branch is a rather thin and narrow muscle which passes down at the level of the anterior end of the heart at right angles to the sternum. The muscle is attached to the outer side of the wall of the sac which encloses the heart and pericardium, and is therefore posterior to all the great vessels which enter and leave the heart. Its fibres, which do not fan out to

Fig. 3.



Thigh-muscles of *Xenopus*.

Sa., sartorius; *St.*, semitendinosus; *R.i.mag.*, rectus internus major; *R.i.min.*, rectus internus minor.

any marked degree, nearly meet those of the upwardly running "*musculus pulmonum proprius.*"

It is evident, therefore, that the "diaphragm" of *Xenopus* is in complexity markedly in advance of that of *Rana* and closely resembles that of *Pipa.*

§ *Myology.*

I have not attempted even so complete an account of the myology of *Xenopus* as I have of *Pipa*, incomplete though that was. I have contented myself with a description of some of the more important muscles which show variations in different types, and from which therefore it may be possible to draw conclusions as to affinities with the very few types of Anurous Amphibians whose myology is known. I have principally made use of Dr. Haslam's translation of Ecker's 'Anatomy of the Frog'[1] as the basis of my comparisons; but I have dissected all the muscles referred to in a specimen of the large Solomon Island Frog, *Rana guppyi.*

The *Rectus abdominis* is a broad muscle which arises not only from the extremity of the pubis but also from the fascia of the thigh, as shown in the accompanying illustration (woodcut fig. 3); possibly, however, the muscle only arises from the cartilaginous plate at the end of the pubis (the prepubis), as I cannot distinguish any distinct line of demarcation between it and the adjacent *obliquus internus.* The fibres pass forward and diverge beneath the end of the sternum into the two recti, which are inserted underneath the sternum.

Obliquus internus. As has been just mentioned, this muscle appears to be quite continuous with the last; but as a portion of the entire muscle underlies the *obliquus externus* and gives off a branch to the lung, it must, I think, be regarded as *obliquus internus.* It will perhaps be in accord with convenience to regard that portion of the entire muscle which springs from the fascia covering the thigh as referable to the *obliquus internus.*

In my account of the myology of *Pipa americana*, I have referred to a remarkable muscle which I termed the "*pectoro-mandibular,*" as descriptive of its origin and insertion. I find in *Xenopus* underlying the mylohyoid a mass of muscle which seems to correspond to this, though its insertions are different. It is, in fact, in *Xenopus* to be regarded as a portion of the deltoid, for its fibres run alongside of other fibres which arise from the clavicle and from the tip of the sternum, and are inserted upon the humerus with the rest of the deltoid; it forms, in fact, the clavicular head of the deltoid.

The *Depressor mandibulæ* arises, as in *Rana esculenta*, from the fascia covering the back, and is in actual contact with the anterior of the *latissimus dorsi.* The dorsal sheet of muscle formed by these two completely covers over the underlying *infraspinatus.*

The *Latissimus dorsi* consists not only of a portion corresponding to the same muscle in the Common Frog, but of a larger posterior portion extending as far back as the margin of the thigh; this has been already described by Maurer[1] and its resemblances to a similar muscle in *Pipa* commented upon by myself[2]. I need not therefore again refer to the matter.

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[1] Clarendon Press, 1889.

The *Cucullaris* is a distinctly oblong muscle when seen before raising the supra-scapula. Its fibres, however, converge beneath the scapula into a long flat tendon, which is inserted into the scapular edge near to its posterior boundary, and where it is also widest. The left supra-scapula here deeply overlaps the right; the muscle, therefore, of the left side is dorsal to the right supra-scapula.

The *Rhomboideus* is a small delicate muscle arising by an oblique origin, which touches the middle line of the back anteriorly and diverges posteriorly; in its course it crosses the *cucullaris* on the outer side (*i. e.* that nearest the arm), and is inserted on to the supra-scapula anteriorly. The muscles are of course completely covered by the supra-scapula.

The *infra-spinatus* is entirely covered by the *latissimus dorsi*; and when this is removed its posterior half is seen to be concealed by the transversus. It is not a double muscle as in *Pipa*; but its line of origin is shaped like the figure 3, being indented in the middle; it does not anywhere reach the border of the supra-scapula. It is inserted in common with the *latissimus dorsi*.

The *Mylohyoid* appears to be entirely similar to the same muscle in the Common Frog.

The *Pectoralis* consists of the three usual divisions. The *portio sternalis anterior* is much larger than the *posterior*; the origin of these two divisions of the *pectoralis* is from the entire length of the sternum; they completely cover all underlying muscles. There is no *musculus cutaneus pectoris*.

Of the two muscles which are brought into view by cutting across and reflecting the sternal portion of the *pectoralis*, the *Sterno-radialis* is much the larger; it takes origin from, at least, two-thirds of the sternum, as well as from the epicoracoid; its fibres converge rapidly to form a narrow flat tendon.

The *Coraco-humeralis* is a large muscle; it arises along the whole of the coracoid and also from the end of the sternum.

The *Triceps femoris* consists of the usual three divisions. The *Rectus anticus* arises from a very narrow tendon, but rapidly swells out into a big muscle which ends in the fascia covering the *vastus internus*. In *Rana guppyi* the connection of this muscle is first with the *vastus externus*.

The *Semimembranosus* is a particularly stout muscle; but it presents no noteworthy particular. Neither does the *Biceps femoris*.

The *Adducter longus* is covered by the *sartorius*; it arises by a narrow stout tendon from the symphysis pubis, and at its insertion is wrapped round the insertion of the *adductor magnus*.

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[1] "Die ventrale Rumpfmuskulatur der anuren Amphibien," Morph. Jahrb., 1895.

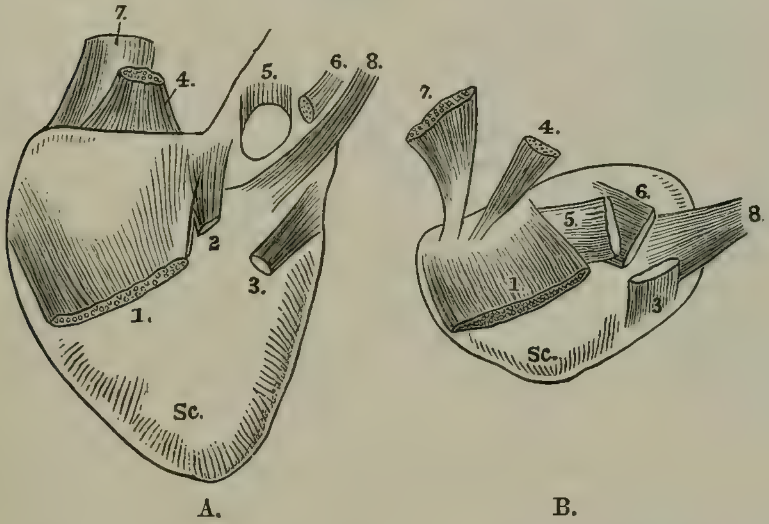
[2] "On some Points in the Anatomy of *Pipa americana*," above, p. 827.

The latter (the *Adductor magnus*) arises behind the *Adductor longus*.

The *Adductor brevis* and *pectineus* form an inseparable fleshy mass.

The *Sartorius* (see fig. 4) is a very much larger muscle than it is in the Common Frog; it is over half an inch in diameter at its widest part. It arises not only from the symphysis of the innominate bones, but from the cartilaginous pre-pubis, and from the septum between itself and the abdominal muscles; it thus appears to arise from the anterior margin of the thigh for about one-third of its extent. The posterior boundary is overlapped and covered for some depth by the *semitendinosus* and *recti interni*. The muscle may be said to have two insertions: one is muscular upon the knee-joint in contact with, but anterior to, the *rectus internus*; the other is upon the tendon and tendinous sheath which covers the end of the *semitendinosus*.

Fig. 4.



A. Under surface of scapula of *Pipa*: 1, 2, 3, transversi scapulares; 4, 5, 6, protrahens scapulæ, levator anguli scapulæ, and sternocleido-mastoid, attaching scapula to head; 7, cucullaris; 8, interscapularis.
B. Under surface of scapula of *Xenopus*: 1–3, transversi scapulares; 4, rhomboideus; 7, cucullaris; 5 and 6 appear to correspond to those muscles so lettered in *Pipa* or perhaps to 4 and 5.

The *Semitendinosus* comes next to the *sartorius*; as already stated, it overlaps it and is itself overlapped, but not wholly concealed, by the *rectus internus*. It is a long thin flat muscle with a single muscular origin; there is no trace of a double origin as in the Frog, nor is there any connection with the *Adductor* *magnus*, such as is figured by Ecker[1] in *Rana esculenta*. The muscle ends in a thin rounded tendon, whose relations with the *sartorius* have been already referred to.

Rectus internus, major et minor. In *Rana* and in *Pipa* there are two perfectly distinct *recti interni*; in *Xenopus* there are also two. The larger of the two, which I take to be the *major*, overlaps the *semitendinosus*, and is overlapped by the *minor*. The latter lies entirely superficial to the *major* and covers its posterior half.

On the outer side of the thigh the only muscles visible without a dissection are the *Semimembranosus* and the outer part of the *Triceps femoris*. The *Biceps* is largely concealed by the *vastus externus*; the great backward prolongation of the *Latissimus dorsi*—to which I have elsewhere[2] directed attention as a point of resemblance between *Xenopus* and *Pipa*—completely covers the *glutæus* and is attached to the thigh.

The *Glutæus*, after removal of the *latissimus dorsi*, is seen to be a very extensive muscle, much larger than in *Rana*. It is inserted by a flat tendon and also by muscle-fibre; between its insertion and the head of the femur is to be seen a portion of the *pyriformis*, which is nearly but not completely covered by it.

The *Psoas* is a fleshy muscle with a long insertion.

In order to effectively display the *pyriformis*, the *glutæus* must be removed or slit up the middle, and the two halves reflected. The *pyriformis* is then seen to be a large bipinnate muscle ending in a stout tendon, attached nearer to the head of the femur than *glutæus*.

§ *Affinities of* Xenopus.

The noteworthy peculiarities in the musculature of *Xenopus* as compared with *Rana* are:—

(1) The large size and attachment of the *Sartorius*.
(2) The single-headed *Semitendinosus*.
(3) The enormous extension backwards of the *Latissimus dorsi*.
(4) The absence of the *Pectoro-cutaneus*.
(5) The attachment of the muscles covering the abdomen to the fascia covering the thigh.
(6) The presence of a sheet of muscle below the *Mylohyoid* which joins the *Deltoid*.
(7) The great extent of the *Pectoral*, which completely covers the *Sternoradialis*.
(8) The large size of the *Glutæus*.
(9) The existence of a special muscle running from the ilium to the lung and œsophagus.

There are also, as will be gathered from the foregoing account of the musculature of the animal, other differences from *Rana* of less importance.

Of the differences enumerated above, (3), (4), (5), (6), and (9) undoubtedly ally *Xenopus* more or less closely to *Pipa*. (1), (2), (7), and (8) are peculiar to *Xenopus*, and distinguish it from *Pipa* no less than from *Rana*.

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[1] *Loc. cit.* p. 100, fig. 83, *st'''*.

[2] "On some Points in the Anatomy of *Pipa americana*," above, p. 834.

Nevertheless I have been able to point out in this paper a few new points of likeness between *Xenopus* and *Pipa*, of which the most important is, in my opinion, the almost identical form of the "diaphragm" in the two genera, which has in both a musculature derived from three sources, instead of from only one as in *Rana*. The enormous *latissimus dorsi*, first described by Maurer, and the extension backwards of the abdominal musculature generally to overlap the thigh, is a strong approximation towards the actual attachment of these muscles to the femur itself in *Pipa*. These additional facts tend to justify the conclusion of Dr. Mivart[1] and of Mr. Boulenger[2], not to mention others, that the two genera should be closely united in any scheme of classification, and perhaps to render this union even closer than has been suggested.

On the other hand, there is the question of convergence raised by Cope to be dealt with. That naturalist suggested some thirty years ago[3] that *Pipa* may be to the edentulous Anura what *Xenopus* is to the toothed forms—that they are, in fact, the summits of their respective series. Dr. Mivart has already discussed the value of the characteristics known at the time when he wrote as evidence of genetic affinity. I shall not attempt any recapitulation, but shall deal here only with the new facts detailed in the present paper. It must be always borne in mind that both *Pipa* and *Xenopus* are among the most purely aquatic of Anurous Amphibia; *Xenopus* is "essentially aquatic, the animal never leaving the water except in search of places where food or shelter are better supplied"[4].

The attachment therefore of the abdominal musculature to the thigh is perhaps more useful to a creature which is as a rule in a horizontal position in the water and which rarely, if ever, adopts the typical frog-like attitude upon the land. This particular resemblance, therefore, between *Xenopus* and *Pipa* may perhaps be regarded as of less importance than some others.

We next come to the lungs and their musculature, for the other myological resemblances between *Xenopus* and *Pipa* are mainly, if not entirely, related to the facts referred to in the foregoing paragraph. One cannot help suspecting that the muscles attached to the lungs render possible a more rapid and thorough filling and emptying of the same with air—an advantage to aquatic though air-breathing animals. The great strength of the respiratory muscles in the whales[5] is an analogy. The very differences between the lung-muscle of *Xenopus* and *Pipa* tend to support the view of their physiological identity, though perhaps morphological non-correspondence.

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[1] "On the Classification of the Anurous Batrachia," P. Z. S. 1869.

[2] B. M. Catalogue of Batrachia Salientia.

[3] Nat. Hist. Rev. 1865.

[4] Leslie, "Notes on the Habits and Oviposition of *Xenopus lævis*," P. Z. S. 1890, p. 69.

[5] Owen, Comp. Anat. vol. iii. p. 578.

On the other hand, the last mentioned suggestion is not certain, especially in view of a statement of Mayer upon the lung-muscle of *Pipa*, which I have quoted in my paper upon that Amphibian. Mayer refers to the origin in *Pipa* of a lung-muscle from the ilium which I have not found myself, but which corresponds with what I have found in *Xenopus*. Apart, however, from the lungs, there is so great a resemblance between the entire musculature which goes to form what I have ventured to term the diaphragm, that I cannot look upon it as a case of convergence due to similar physiological needs. The only possible test for discriminating between morphological resemblance and a likeness due to similar needs would appear to be the complexity of the structures in question. Judged by this test, I am inclined to regard the new facts put forward in this paper as evidence of relationship between *Xenopus* and *Pipa*.

3. On the Colour-variations of a Beetle of the Family *Chrysomelidæ*, statistically examined. By W. Bateson, M.A., F.R.S., Fellow of St. John's College, Cambridge.

[Received December 3, 1895.]

(Plate XLVII.)

At a meeting of the Society on May 1, 1894, I exhibited living specimens of *Gonioctena variabilis* in illustration of the remarkable range of colour-variation in the species. Since then I have had opportunities for a fuller investigation of the matter, and the following paper is an account of the results obtained.

G. variabilis[1] is a small beetle, about ¼ in. long, belonging to the family Chrysomelidæ. It lives on *Spartium retama*, a plant allied to the Common Broom, very generally distributed in hilly places in the south of Spain, though absent, I believe, from the limestone districts. This plant grows as a bush varying in height from one to about seven feet according to the situation, humidity, and exposure. The stunted form is dense and compact, having stout branches spreading out more or less horizontally, giving off erect leaf-bearing stems set closely together. The tall form is slender and graceful, and its leaf-bearing stems are generally pendulous and wavy. In their extreme forms these two conditions of the plant differ considerably from each other, but all intermediate conditions are found.

In colour the stems of this *Spartium* are of a dull greenish grey. The surface is marked with irregular longitudinal ribbings, which give it an appearance of faint striping. It is upon the stems of this plant that the beetles live, infesting both forms indifferently. When at rest they are commonly seen sitting with their heads in the axils of the twigs, their bodies being closely pressed against

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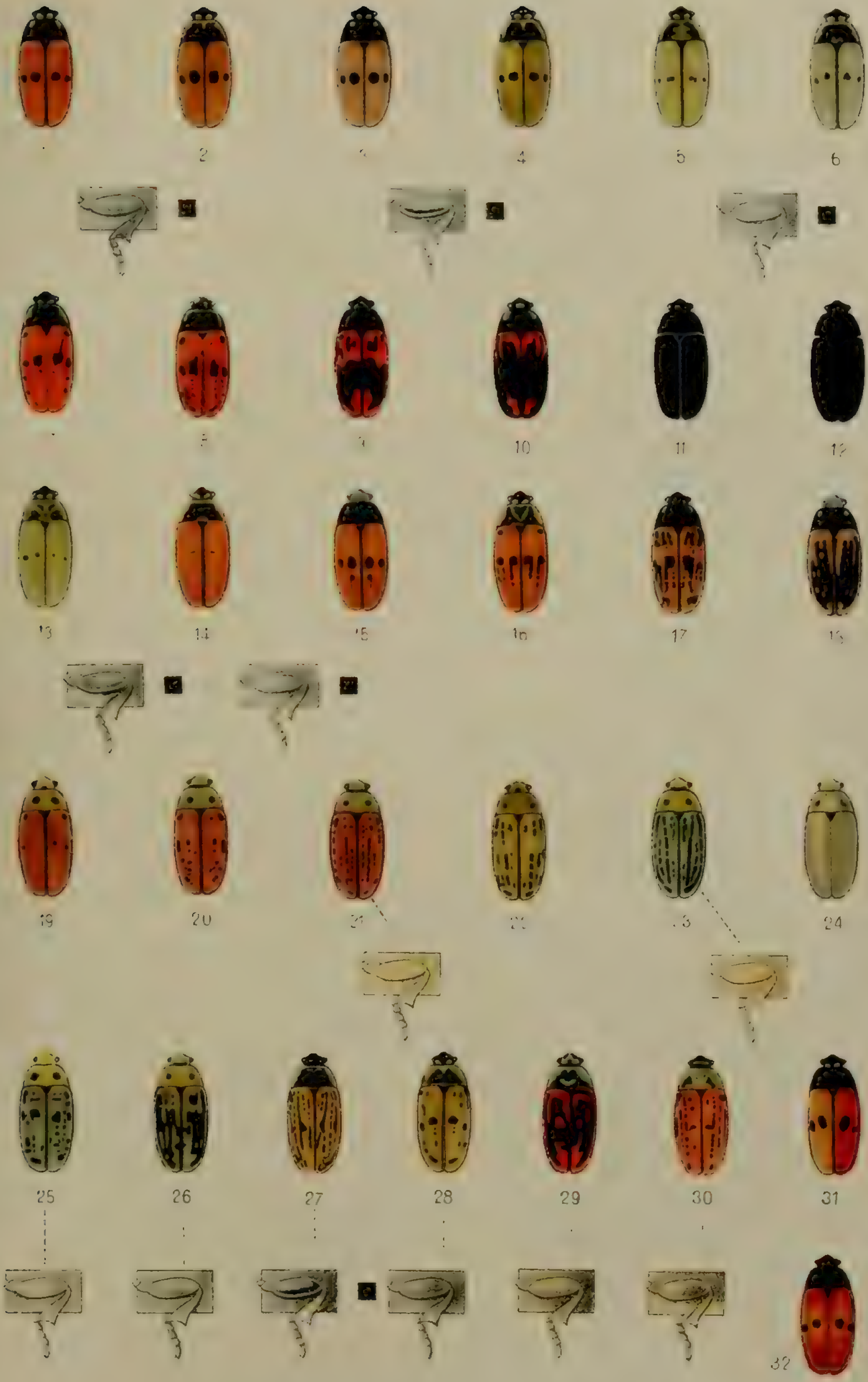
[1] The genus *Gonioctena* is *Phytodecta* of the Munich Catalogue. The species *G. variabilis* is the *Phytodecta ægrota* of Fabr. and Suffr.



VARIATIONS OF GONIOCTENA VARIABILIS.

Edwin Wilson Cambridge.

ATURAL HIS

the surface. Several other species of *Spartium* grow in the south of Spain, but I did not find *G. variabilis* on any of them. Nevertheless, living specimens brought home to England ate the shoots of *S. juncifolium*, with which they were provided from the Cambridge Botanic Garden.

It was at Granada, on March 28, 1894, that I first saw *G. variabilis* and was at once struck by the great variety of appearance presented by different individuals. In a few minutes I came upon most of the chief kinds, including what will be described as the red form with black spots, the greenish-grey form with black stripes, a totally black form, &c. As may be seen from the figures (Plate XLVII.) these different varieties are strikingly unlike in general appearance, and not having previously heard of this beetle I at first doubted whether all were one species. Then, finding specimens of dissimilar colours coupled together, I concluded that they did all belong to the same species, and as all intermediate forms were afterwards found, there can be no doubt on this point. Subsequently Dr. D. Sharp, to whom I am indebted for much help in examining these specimens, gave me the name of the beetle and told me that it was known to undergo great variation in colour[1]. I may add further that no difference could be seen in examination of the ædeagus of the several forms.

It appeared that the case was worth further investigation with the object of determining with what frequency the various colours occur, and to what extent specimens collected at random could be grouped round special type-varieties to the exclusion of intermediate forms, thus manifesting the phenomenon known as organic stability in respect of those varieties. As so many specimens were found *in cop.* it seemed further that by recording the colours of specimens so coupled it might be possible to get an indication whether there existed any operative sexual selection as to colour.

The next few days were spent in gathering a sufficient sample, and I then returned to Gibraltar to follow other work. Very soon, however, I found that the colours had so faded that the collection already made was useless for my purpose. In fact, in dried specimens the red and the green both usually fade to an indifferent brown. I therefore went back to Granada and gathered a fresh sample of about 1500. These I put into a large wooden box and brought alive to England. In the following year (1895) I returned to Granada and collected, on March 24–28, about 2500 more, recording all the colours at the time.

It at once appeared that the colour is to a great extent dependent upon sex, the males being generally of the red form with spots like fig. 1, while the females are generally of the greenish form with stripes like fig. 23, though every colour is sometimes found in each sex. For this reason, before sorting the specimens for the purpose of determining the frequency of each colour, it is necessary first to sort them in respect of sex. This can be done without much difficulty. Besides a slight difference in shape and in sculpture (which gives to the elytra of the female a duller lustre) there is a well-marked depression or pit in the last uncovered abdominal plate of the male, while in the female there is no such depression.

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[1] Several varieties have been briefly described by Weise (Deut. ent. Zeitschr. 1891, p. 160), but I infer that the colours were given from dried specimens.

In attempting to arrange or group the specimens according to colour confusion is caused by the fact that variation occurs in several distinct features. Of these the three most noticeable are:

(1) The ground-colour of the elytra.
(2) The distribution of black pigment on the elytra.
(3) The colour of the legs and underside of the body.

Since the variations of the first two points are largely independent, it is not possible to exhibit the relationships and frequencies of all the variations by arranging the specimens in *one* series. The whole number, males and females, can, however, be seen to consist of two chief kinds—the one distinguished by having four *black spots* on the elytra (figs. 1–6, &c.) and a dark, generally black, underside to the body, while the other has an appearance of *black striping* on the elytra (figs. 20–23) associated with a light testaceous underside to the body. Those with undersides that cannot at once be referred to either the dark or to the light division are rare; in the Tables given they are included under the heading "unconformable." In those with light undersides the legs are of a similar testaceous colour. If the underside is black, the femora are generally black too; but frequently the coxæ and tarsi, and less often the tibiæ, are of a lighter colour.

Examined closely the distinction between the distribution of the spots and the stripes is seen to be as follows:—The striping consists of pigment deposited in certain positions that can be defined pretty accurately by reference to the punctulations. These are somewhat more regularly disposed in the female than in the male, but by standing back to the light and looking at the specimen from behind it can be seen that the following arrangement is fairly constant. Following a line across the middle of an elytron there is next to the suture a double row of punctulations. External to this is an interval. Then come the 2nd–8th double rows of punctulations separated by intervals. Outside the eighth interval is a 9th row of punctulations, which is irregularly treble.

It is in the four intervals between the 2nd and 3rd, 4th and 5th, 6th and 7th, 8th and 9th double rows that the four chief tracheæ of the elytron run; but the four principal stripes of pigment are placed in the *other* intervals, viz., between the 1st and 2nd, 3rd and 4th, 5th and 6th, 7th and 8th double rows of punctulations. There are not rarely a few dots of pigment in the other intervals, and, in the case of heavily striped specimens, these sometimes unite to form secondary stripes.

The definite "spots," however, that are associated with the black undersides (as in fig. 1, &c.) consist of patches of pigment usually placed so as to *cross* respectively the one the 2nd, 3rd, and 4th, the other the 7th and 8th double rows of punctulations. The extent of these spots varies greatly and in its condition of least development the central of the two spots coincides very nearly with the 3rd double row of punctulations, and the lateral spot similarly is very nearly on the 7th double row.

All these arrangements are liable to irregularity, but in the main they are as described, and essentially in the spotted form pigment *crosses* certain of the double rows of punctulations, while in the striped form it is almost entirely in the *intervals* between them.

The association of the black spots on the elytra with a dark underside is exceedingly close, and it scarcely ever happens that a specimen which has black pigment in the position of the spots (fig. 1) has a light underside. This principle is obeyed whatever the ground-colour of the elytra may be. Figs. 25 and 26, 28–30 are given as illustrations of specimens in which the rule is not followed, the undersides not being black though there is black pigment on the elytra in the situation of the spots.

This division into spotted forms with dark undersides and striped forms with light undersides is the most conspicuous feature in the variation of the insect. In great measure the distinction is sexual, most of the males belonging to the spotted division and most of the females to the striped. Curiously the number of each sex which belongs to the opposite group is about the same, for on sorting it appears that

Of *males* about 80 per cent. are of the spotted class.
" " 18 " " striped "
Of *females* " 25 " " spotted "
" " 71 " " striped "

This reckoning is made without reference to ground-colour, and specimens that have striping as well as spots are of course included in the spotted class, to which they belong also by reason of their dark undersides.

Of the spotted form the great majority (73 per cent. of all males and 19·6 per cent. of all females) have red as the ground-colour of the elytra. Of the striped form, on the other hand, the majority (19 per cent. of all males and 65·7 per cent. of all females) have greenish grey as the ground-colour. In fact the great majority of males agree pretty closely with fig. 1, while the great majority of females resemble fig. 13; but of the males the *next commonest* form is that shown in fig. 13, and of females the second commonest is that of fig. 1. It thus appears that the form which may be called normal for the female is the commonest variety in the male, and the converse is true though to a less degree.

The thorax of the striped forms usually has black pigment as two black spots (see figs. 19–24), while in the spotted forms the thorax is generally black with some lighter colour at the periphery and not rarely in the middle line.

Considering the *ground-colour* of the elytra there are thus two chief kinds, red and greenish grey. The majority can at once be referred to one or other of these two. Nevertheless there are intermediate colours forming an unbroken series or transition from the one to the other. Such a series is represented in figs. 1–6. Starting from the bright red kind (fig. 1) and passing through a duller red (fig. 2) a neutral buff (fig. 3) is reached. This buff is almost exactly intermediate between the red group and the greenish grey. The next stages in the transition are yellow (fig. 4), yellowish green, and greenish grey (fig. 6).

Taking *spotted* males alone the bright reds are by far the commonest, the duller reds are the next commonest, the buff are very rare, while yellows and greenish together make up a fair group. As to the relative frequency of these yellows and greens, the data are unreliable. The total number belonging to these classes was small, and it is not possible to sort them among themselves with any strictness. I am satisfied that the yellows are more common than the buffs, and the *spotted* greenish greys are probably less common than the yellows; but of this I am not sure. In the Table given at the end I have united them.

Of *striped* males almost all are greenish grey. Reds and yellows occur, but are exceedingly rare. The whole number of striped specimens with a ground-colour other than greenish grey is so small that it is not possible to judge the frequency of the respective colours. I attempted for some time to distinguish different shades of the greens according to the degree of yellow. But while certain of the striped kinds are obviously yellow and others are obviously yellowish green, it was not found possible to sort consistently the yellowish greens from the greens with less yellow, so this attempt was abandoned.

With a view to determining the nature of the colouring-matters, an examination of some specimens was very kindly made by Dr. H. C. Sorby. The material sent to him consisted of a few of the reds and a few of the greenish form separately killed and preserved in alcohol. Dr. Sorby informs me that the red pigment is slowly dissolved out by alcohol and carbon bisulphide, and when in solution in the latter is of exactly the same character as the similar pigment of the common Lady-bird (*C. bipunctata*). After long action to dissolve out all the pigment of the elytra, the red form is left of a yellow colour, exactly like that which is assumed also by the greenish kind. Dr. Sorby therefore conjectures that the reds differ from the others mainly on account of the development of the red pigment which is not found in the others. It is therefore possible that the ground-colours intermediate between the red and the greenish may be due in some measure to a difference in the amount of red pigment; but it seems likely that in the case of the yellow, which is a distinct colour, there must be an alteration in the nature of the pigment.

Specimens are occasionally found having the elytron of one side red and that of the other side yellow (fig. 31). Not very rarely also there are more or less distinct patches of yellowish colour on the red ground, as in fig. 32, where they happen to be nearly symmetrical. These specimens are included in the Tables under the head of "unconformable."

In addition to the varieties already mentioned, there is also a series of melanic forms. We have seen that the black pigment of the elytra may either take the form of stripes or of spots. From the latter group (fig. 1) a noticeable series of variations leads to a form totally black above and below. Such a series is illustrated by the figures 7–12 and 15–18. The first step in the progressive pigmentation consists in the appearance of black in the positions of the stripes, which is gradually extended. These specimens are thus both spotted and striped. The parts last invaded are the apices, the shoulders, and the borders of the elytra[1]. The spread of the black is perhaps never quite symmetrical on the two sides and is not rarely noticeably asymmetrical to the degree shown in the figures.

The series of progressive pigmentation is closely parallel to that seen in *Coccinella bipunctata*, the common Lady-bird.

Though the invasion of the black pigment proceeds along tolerably regular lines, darkening the parts of the elytra in a fairly constant order, yet as regards quantity of pigment variation towards the black form proceeds continuously, the states becoming successively rarer as the full black is approached. From the fact that the progress is so even it is not easy to give numerical expression to this; but on sorting the specimens which have more black than fig. 1, it is found that while there are many which approximate to figs. 7 and 8, there are fewer which resemble figs. 9 and 10; those with only a few specks of red, like fig. 11, are still rarer, while the totally black state is rarer than any of the others.

The darkening of the head and thorax proceeds more or less evenly with those of the elytra, but the correlation is not strict.

These melanic forms are, as has been said, an offshoot of the spotted kind and not of the striped. They have red as the ground-colour almost without exception. Fig. 26 represents the darkest specimen I have seen with greenish ground-colour.

A few specimens are found without any black markings on the elytra at all. These have the undersides testaceous. In such specimens the thorax has generally very little pigment and is occasionally entirely without any.

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[1] Curiously enough, the two specimens figured by Olivier, Hist. Nat. des Insectes, pl. viii. fig. 127, *c* and *d*, are both of these very melanic forms. The locality is not given, and perhaps the frequency of the varieties may differ with locality.

There is some suggestion that the frequency of the different variations may be in part dependent on locality. The great mass of my specimens were collected on the hills that extend behind the town of Granada, separating the two valleys of the Genil and the Darro. In the first year I made a separate collection also from the *Spartium* growing near the bottom of the Darro valley. I noticed at once that the proportion of the striped forms with greyish-green ground-colour was much larger than it had been in the case of the hill-locality. Unfortunately I was not at that time expert in sorting the sexes, and this Darro sample was eventually mixed with the rest that I brought, living, to England. The colours were recorded, but without reference to sex.

The second year, however, I made another attempt to get statistics of the Darro population, and give the result in Table II. The total numbers are unfortunately small, as the available area on which the *Spartium* grows is not extensive; but the quantity is sufficient to show that the proportions are markedly different from those of the hill-sides, for while on the hill-sides 19 per cent. of males are of the striped greenish grey, in the Darro valley about 37·7 per cent. are of that colour. I am disposed to think this difference in proportion is a perfectly genuine phenomenon and not merely an accident of collection, but I can suggest no cause for it. The difference in altitude is very slight, averaging, perhaps, 300 feet. No doubt the Darro bushes are rather larger and better watered, but many of the bushes on the hills are of the same character and I did not find a high proportion of greens on them. The Darro valley is no doubt less exposed and rather hotter than the hill-sides, but it would not be easy to point to a specific difference.

A peasant employed as a "Guardia Municipal," with whom I made acquaintance, collected for me a considerable sample of some hundreds from Pinos, higher up the Genil valley. The proportions agreed fairly with my Granada sample; but as I knew nothing of the way in which they had been collected, the numbers are not worth giving.

On the 20th of March, 1895, during an interval between trains at Castillejo[1], a place not far from Toledo, in a hasty sweeping I got 75 specimens, only one being a female. Of these none are of the striped greenish-grey form. The number is of course too small to justify a conclusion; but the result is remarkable, for according to the Granada experience there should have been about 14 such specimens. It is possible that in this more northern locality the proportions may be different. The scarcity of females is also to be noted and may perhaps be due to comparative backwardness of the season.

It seems that at Granada at all events the beetles are to be found for a considerable part of the year, for Mr. Nicholson has kindly sent me a small gathering made in the month of June.

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[1] As travellers from Toledo for the south generally have to wait some hours at Castillejo, it is not unlikely that some entomologist may find an opportunity of looking into this matter. The *Spartium* grows in quantity near the station.

In the Table the frequency with which specimens of each colour were taken *in cop.* is recorded. In each case special care was taken to see that the pair were actually coupled, and none were counted for this purpose unless they remained attached when removed from the bush. It will be seen that the numbers agree very fairly well with those that they should be if the coupling occurred by simple chance, for the number of each colour found coupled bears about the same proportion to the whole number found coupled that would be expected according to the frequency of that colour.

It is clear that we have here an example of a species whose members exhibit variation in several different respects, and that the variations occur in such a way that the individuals must be conceived as grouped round several subtypical forms. There is thus not one normal for the species but several. Next, though all are living in the same locality under the same conditions, and though they breed freely together, these various forms are commoner than the intermediates between them[1]. Upon the significance of such a case I have sufficiently commented elsewhere[2].

One point may be of interest to students of the adaptation of the colours of animals to their surroundings, namely the fact that while the red-spotted forms are strikingly conspicuous objects the striped greenish-grey forms resemble so nearly the colour of the twigs of the *Spartium* that it is impossible not to remark the likeness. If they were the only form known, the case might well be used as an illustration of a protective coloration. The red-spotted forms present some superficial likeness to the common Lady-bird (*C. bipunctata*), a creature which exudes an acrid juice, and whose colour has naturally been classed among "warning colours." The *Gonioctena* does not, so far as I know, possess any such irritant properties, but I have no information as to its enemies. As *Coccinella bipunctata* is not very common on the *Spartium*, probably no one will suggest that we have here an example of protective mimicry. I may mention, however, that *Coccinella septempunctata*, the larger scarlet species, occurs in vast quantities mixed with *Gonioctena*. Whether anyone would consider the resemblance to this species sufficiently close to constitute mimicry, I cannot say.

Speaking of the excessive variability of the colour of *C. decempunctata* and of the no less striking constancy of *C. septempunctata*, which lives with it, I remarked[3] that to ask us to believe that the colour of the one is constant because it matters to the animal, and that the other is variable because it does not matter, is to ask us to abrogate reason. Mr. A. R. Wallace, in a recent article[4], takes exception to this comment, saying that he, for his part, is of this

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[1] As was pointed out, this is not true of the *black* variety.

[2] 'Materials for the Study of Variation,' 1894, pp. 48, 72, &c.

[3] *L. c.* p. 572.

[4] 'Fortnightly Review,' March 1895, p. 436.

TABLE I.—*Granada*, 1894 *and* 1895.

Collected on the hills between Darro and Genil.

	Swept.	Taken *in cop.*	Totals.	Percentage.
MALES.				
Undersides dark.				
Spotted: ground-colour bright red	1657	139	2186	73·7
,, ,, duller red	390			
Spotted and striped, tending towards black } ground-colour red.	177	9	186	
Spotted: ground-colour reddish buff	39	...	39	
,, ,, neutral buff	25	...	25	
,, ,, yellow to greenish grey.	100	12	112	
Black all over	7	1	8	
Striped only: ground-colour greenish grey	3	...	3	
No stripes or spots: ground-colour red	1	...	1	
Unconformable	35	3	38	
			2598	81
Undersides light.				
Striped: ground-colour greenish grey	596	24	620	19
,, ,, red	5	...	5	
,, ,, yellow	1	...	1	
Spotted and striped: ground-colour greenish grey	2	...	2	
No stripes or spots: ground-colour plain red	2	...	2	
Unconformable	2	...	2	
			632	19
Total captured		188	3230	
FEMALES.				
Undersides dark.				
Spotted: ground-colour red	102	27	129	19·6
Spotted and striped, tending towards black: } ground-colour red.	42	9	51	
Spotted: ground-colour buff	5	...	5	
,, ,, yellow to greenish grey	34	13	47	
Black all over	9	3	12	
Unconformable	5	3	8	
			252	27·5
Undersides light.				
Striped: ground-colour greenish grey	497	116	613	65·7
,, ,, yellow	26	14	40	
No black: ,, plain red	1	1	2	
Unconformable	8	2	10	
			665	72·5
Total captured		188	917	

TABLE II.—*Darro Valley*, 1895.

	Swept.	Percentage.
MALES.		
Undersides dark.		
Spotted: ground-colour red	341	58·3
" " duller red	41	
Spotted and striped, tending towards black: ground-colour duller red	37	
Spotted: ground-colour buff	5	
" " yellow to greenish grey	17	
Black all over	3	
Unconformable	3	
	447	62·3
Undersides light.		
Striped: ground-colour greenish grey	270	
No black: " red	1	
	271	37·7
Total captured	718	
FEMALES.		
Undersides dark.		
Spotted: ground-colour red	9	
Spotted and striped: ground-colour red	7	
Spotted: ground-colour buff	5	
" " yellow to greenish grey	6	
Black all over	1	
	28	14·4
Undersides light.		
Striped: ground-colour greenish grey	164	
" " yellow	3	
	167	85·6
Total captured	195	

very opinion. On the question *how* it is that the colour of *C. septempunctata* is so important, and the colour of *C. decempunctata* unimportant to the animal, I do not find Mr. Wallace offering evidence, and I am not aware that he has even hazarded a guess. Meanwhile I wish to repeat, in regard to *G. variabilis* what I said before in the case of *C. decempunctata*, that its several varieties exhibit that kind of definiteness and constancy to their respective types that we associate with the idea of species; but for supposing that this constancy is in any way dependent on adaptation to environment, we have no warrant.

EXPLANATION OF PLATE XLVII.

These figures have been drawn by Mr. Edwin Wilson from the living specimens. The colours were very carefully copied, but it was not thought necessary to reproduce the sizes and shapes of the individuals. The figures are about twice the natural size.

With the exception of figs. 18, 22, and 27, which represent females, all were taken from males.

Figs. 1–6. Series illustrating the change of ground-colour from red to greenish grey.
Figs. 1, 7–12 are a series illustrating the progressive invasion of black pigment.
Figs. 13–18. Various forms illustrating diminution and increase in amount of black pigment.
Figs. 19–24. Forms with light undersides.
Figs. 25–30. Unconformable cases.
Figs. 25, 26, 28, 29, and 30 show specimens having light undersides, though they have transverse black markings in the position of the spots.
Figs. 27 and 28 are peculiar in the fact that, though melanic forms, the ground-colour is yellowish buff instead of red.
Fig. 30. Underside of intermediate colour, associated with a slight indication of transverse black marking.
Fig. 31. Specimen having right elytron red and the left yellow.
Fig. 32. Specimen having patches of yellow on red elytra.

The undersides were black in the case of figs. 1–18, 27, 31, and 32; light in the case of figs. 19–26; of intermediate colour in the case of figs. 28–30.

A leg is drawn in some cases, and the small square beside it represents the colour of the underside without shading. The elytra are all coloured as if they had no high light on them, in order to give the colour more correctly, but actually they reflect a bright light.

4. On the Affinities of the so-called Extinct Giant Dormouse of Malta. By R. Lydekker.

[Received October 2, 1895.]

It has always been a matter of some surprise that while the other extinct Dormice agree with the living members of the family in their comparatively small size, the rodent from the Pleistocene of Malta assigned to the genus *Myoxus* is a much larger animal, agreeing approximately in dimensions with the Oriental *Sciurus bicolor*. Recently Mr. Andrews, of the British Museum, told me that he believed this so-called Dormouse was not a member of the *Myoxidæ* at all; and this induced me to undertake a re-examination of the specimens in the Museum, with the result that I am quite convinced of the correctness of his opinion.

Myoxus melitensis was first described by Leith Adams in the Journ. R. Dublin Soc. vol. iv. p. 18 (1863), and more fully in the Trans. Zool. Soc. vol. vi. pp. 307 *et seq.*; while some of its remains were also figured in plate iii. of his 'Notes on the Nile Valley and Malta' (1870). The name *Myoxus cartei* also occurs in the same memoirs, although this appears to be a synonym of the former. Among the remains figured from Malta there is, however, a lower jaw[1] assigned to the young of *M. melitensis*, which appears to belong to a true Dormouse and, from the presence of a perforation near the angle, may be assigned to the genus, or subgenus, *Eliomys*.

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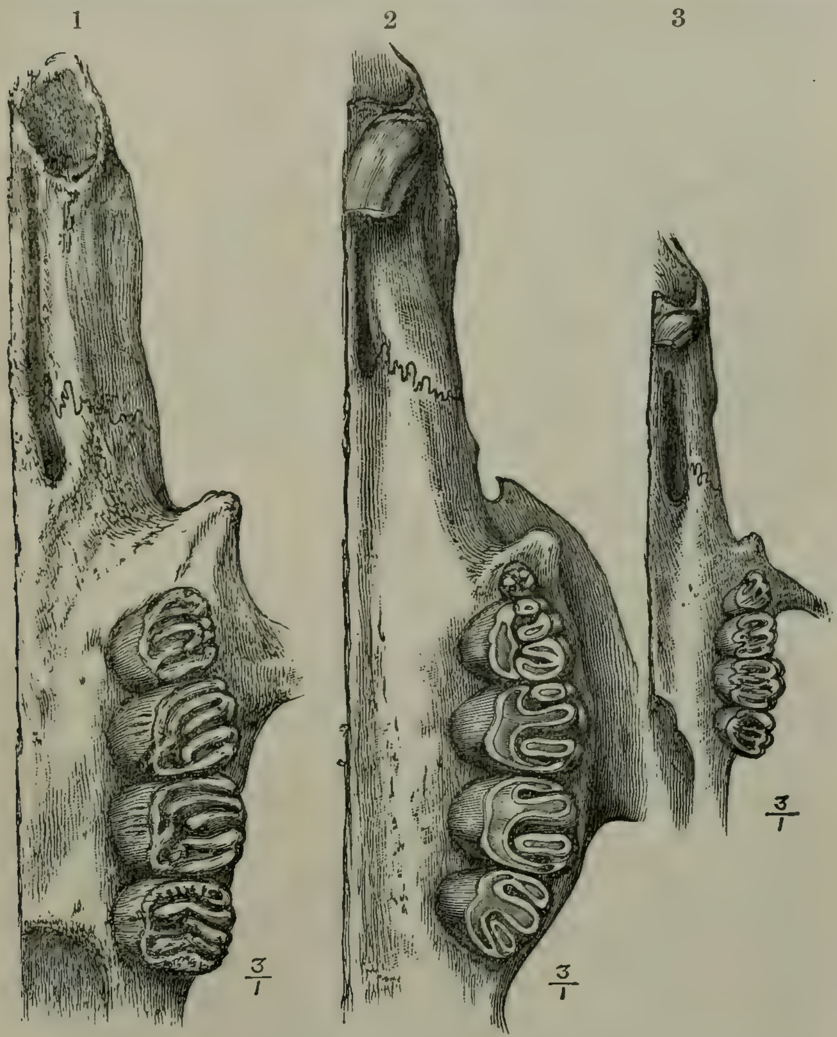
[1] 'Nile Valley and Malta,' pl. iii. fig. 7.

Unfortunately, none of the skulls or lower jaws in the British Museum are complete, although some of the latter are sufficiently well preserved to show that the angle is constructed on the plan obtaining in the Sciuromorpha and Myomorpha. One example of the cranium shows a very important difference from the *Myoxidæ* in the region of the snout. In all the members of that family the infraorbital foramina are large and open in the maxilla at the fore root of the zygoma, in a manner somewhat similar to that obtaining in the *Muridæ*. On the other hand, in the *Sciuridæ* the same foramina are of very minute proportions, each forming merely a small slit at the junction of the premaxilla with the



Left upper cheek-teeth of (1) *Leithia*, (2) *Xerus*, and (3) *Myoxus quercinus*.

maxilla, situate considerably in advance of the anterior zygomatic root. Now in this respect the fossil apparently differs from the Dormice and resembles the Squirrels[1].

As regards the cheek-teeth, these present a considerable superficial resemblance to those of such Dormice as have complicated enamel-folds on the crown. Closer examination shows, however, a marked difference, well displayed in the accompanying figures (p. 861). In the simpler type of upper molars in the Dormice (*Eliomys*) the folds form ridges, of which two unite to form columns on the outer side of the crown, so as to give a somewhat tritubercular form to the whole tooth; and where the ridges are more complex (*Myoxus*), and form more distinct plates, these curve together in pairs on the outer side of the crown. On the other hand, in the Maltese animal the four or five blunt ridges diverge from the inner or postero-internal portion of the crown in a comb-like manner, without any tendency to approximate on the outer border, one or two of these ridges being shorter than the rest and arising by a splitting of the enamel-folds. Both *Eliomys* and *Myoxus* have distinct outer columns to the upper molars, while *Muscardinus* differs markedly from the fossil in that the upper premolar is very small and the first molar much longer than the second. The foldings, too, on the second molar are much finer and of a different type.

Comparing this type of dentition with that of the *Sciuridæ*, the nearest approximation is presented by *Xerus* and *Pteromys*. In the former two main ridges and two talons proceed outwards from an inner wall; and in the latter this inner wall becomes thinner, and the two talons are so developed as to be counted as ridges. Although these ridges and the three intervening enamel-folds, or valleys, are much deeper than in the Malta form, yet it seems not impossible that both types of teeth might be derived from a common stock.

Seeing, therefore, that the Maltese rodent does not belong to the *Myoxidæ*, while it presents certain resemblances to the *Sciuridæ*, I think it may be provisionally assigned to the Sciuromorpha, although it is quite probable it may constitute a family (*Leithiidæ*) by itself. As it requires a new generic title, the name *Leithia*, after its describer, may be suggested; and the genus may be provisionally defined as specialized Sciuromorpha with squared upper molars bearing from four to five simple, low, parallel transverse ridges, three of which rise from the postero-internal angle or inner side of the crown, while the remainder are shorter and are formed by a single or double splitting of the more anterior of the two hindmost enamel-folds. There is no trace of the presence of more than one pair of upper premolars. The palatine foramina are elongated, and the tibia and fibula united. Whether the skull had the well-developed postorbital processes characterizing existing Squirrels, I am unable to determine; but it was evidently constricted in the orbital region, like *Sciurus*, and thus unlike that of *Xerus*. The restoration of the lower jaw given by Leith Adams is probably incorrect. It is certain that *Leithia* does not belong to the Myomorpha, and I do not think the features in which it differs from other Sciuromorpha are sufficient to justify its reference to a suborder by itself.

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[1] As pointed out to me by Mr. de Winton, the palatine foramina differ from those of existing Sciuromorpha in extending backwards well into the maxillæ, as in the Myomorpha, instead of being confined to the premaxillæ. In *Arctomys*, however, these foramina intrude somewhat into the maxillæ, so that the feature does not seem of much value. Neither am I inclined to attribute very much importance to the distal union of the tibia and fibula which takes place in the fossil form, although such union is unknown in the living Sciuromorpha, while it is universal in the Myomorpha.

5. On Loder's Gazelle in Egypt, and the Mode of its Capture by the Arabs. By W. E. Jennings Bramley.[1]

[Received October 23, 1895.]

On the 27th of June I started from the Pyramids in order, if possible, to catch some living specimens of Loder's Gazelle (*Gazella loderi*)[2], known to the Arabs as *Rasal Abiad* (the White Gazelle), which the shikaries whom I took with me reported to be found in the desert at some thirty or forty miles distant from Cairo.

Leaving at 4 P.M. on the 27th, we started, taking a south-easterly direction. We travelled till 12 that night, and at 4 next morning resumed our march. Soon after the sun had risen, one of the shikaries, pointing to the ground, showed what he made out to be the spoor, evidently but lately made, of a fine male Loder's Gazelle. This, being larger than that of the Dorcas Gazelle, is very easily recognizable; the bluntness of the hoof in the case of Loder's Gazelle shows a marked difference. About 12 o'clock one of the camel-men called out that a Gazelle could be seen ahead, but the many heaps of white stones, scattered all over the desert, are so deceiving at a little distance that both shikaries shook their heads.

The habit that all Gazelles have, when first viewing an approaching danger, of standing motionless for some time, is carried to such an excess in this particular species that it is often possible to get within easy rifle-range by quietly walking up, without taking any particular care to hide the approach. On the other hand, the animal is often missed entirely, and passed by at some little distance as a heap of bones or of white stones.

The camel-man, however, in this case proved to be correct, as we soon noticed the Gazelle walking leisurely away. It disappeared behind a mound of sand, where it must have remained, for, on reaching the place about half an hour later, we were surprised to come suddenly on the Gazelle, now only some 200 yards off. It was a fine female, very white in colour. Not wishing to disturb any others that might be near, I did not fire. We found, however, that it was alone. At 12 o'clock or thereabouts we came upon the skirt of the plateau, from which the Fayoum can be seen, and here the shikaries decided to turn back, as they said we had passed the "White Gazelle ground;" so, after returning about two miles, we set up the tents and waited for the evening, the sun being so hot that it was impossible to continue our search. Two Arabian greyhounds I had with me felt the heat especially. No sooner were the camels on the ground than, going to the shady side, they began to dig in the sand under the beasts in order to bury themselves away from the heat.

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[1] [Mr. Bramley has kindly drawn up these notes at my request. It will be recollected that the existence of Loder's Gazelle in Egypt has only lately been established upon a specimen procured by Mr. Bramley. *Vide suprà*, pp. 400, 522.—P. L. S.]

[2] Thomas, P. Z. S. 1894, p. 470, pl. xxxii.; Scl. *suprà*, pp. 400, 522.

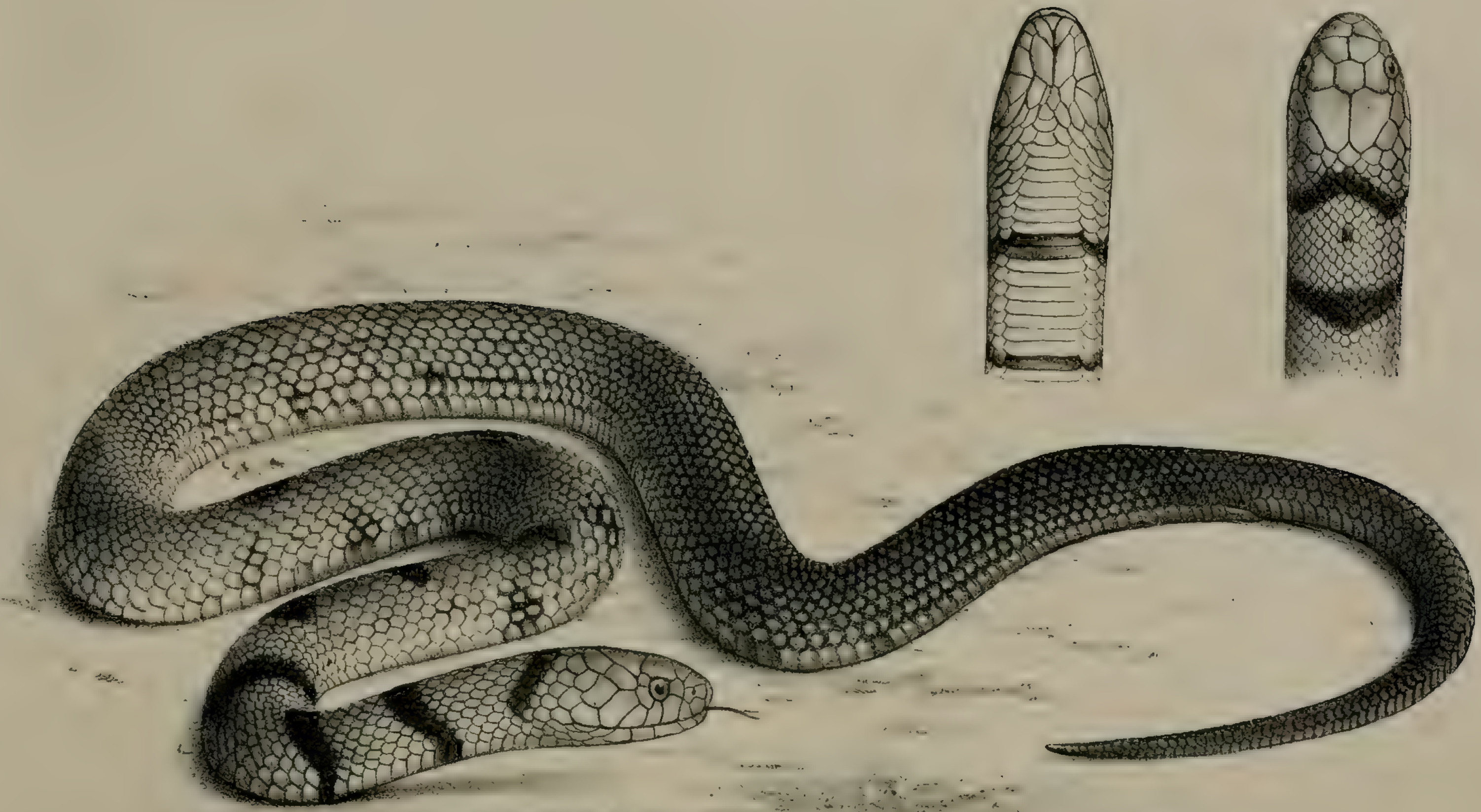
During the afternoon the two shikaries constructed traps, which we set in the evening.

The Gazelle trap, except the small hemp-platted rope, is made entirely from the date-palm. Taking the long leaves, the shikarie first constructs by platting them together a deep ring, about 3 inches in diameter and about 4 inches deep: it should, in fact, fit well into a golf-hole and make its walls secure. He now takes an old stalk from which the dates have been picked, and separating about twenty of the fibres which compose it, and run its whole length, he twists them into a rude bracelet about three inches in diameter. Then taking three more fibres, in place of twine, he binds the ring securely; the ring or bracelet has then a form much resembling a diminutive "Ringold" ring. The shikarie now breaks off the points of the date-thorns until he has about twenty-five of them 2 inches in length; these he pushes through the fibrous sides of the ring until all the points meet in the centre, so that when finished this ring has much the appearance of a small sieve. All the thorn-points overlap slightly in the centre of the ring. This ring, holding all the thorns, the deep ring of platted leaves, and a soft thick hemp rope, made by the Arab himself, by the ordinary three-plat from raw hemp (this rope, being soft, not only binds itself more securely to the Gazelle, but does not cut the skin when drawn tight), attached to a date-stick about a yard in length, are all the implements that an Arab requires to catch a Gazelle.

Starting in the evening for the lower ground, which is studded with small bushes (for when pitching the tents we purposely kept at a good distance from the feeding-ground), we soon found spoor, but none very promising; a buck and two does had been there two nights before. A small desert plant, much resembling our English Red Cranesbill (*Geranium sanguineum*), was pointed out to me by the Arabs as a favourite food of the Gazelles. Finding a spot where the spoor led to one of these plants, and the plant evidently having been nibbled at, we decided to put a trap near it. The Arab sat down and made a hole, using his deep ring to keep its sandy walls intact, so that he now had a hole resembling exactly in size and depth a golf-hole with basket-work sides, within four or five inches of the plant.

Taking now the thorny ring he places it on the hole, which it should exactly cap. He now powders up some camel-dung and

NATURAL HISTORY



H. Grönvold del. et lith.

Mintern Bros. imp.

BOULENGERINA STORMSI.

drops it carefully over the thorns in the ring, which being close together hold it up, so that soon nothing can be seen of the thorns. The use of the dried dung is, to hold up the sand which hides the trap. The hemp rope, now made into a slip-noose, is put round the top ring, and the stick to which it is attached buried in the sand. The whole is now carefully covered with sand. One of the shikaries laid his traps so successfully that it was almost impossible to find one again unless a Gazelle was caught in it. The marks like those of a Gazelle made by the fingers over the trap add to the deception. It is curious to remark that a Gazelle will rarely walk over an impression left by either beast or man in the sand.

When the Gazelle comes in the evening to feed, its foot slips through the top ring in the centre where the thorns meet, and so to the bottom of the hole. The top ring is now fixed round the Gazelle's leg, at the height of the depth of the hole, the spiky thorns entering the skin. This ring also holds up the hemp rope, which the Gazelle, in endeavouring to kick off the thorny ring that pricks it, draws tight, generally over the knee.

The Gazelle starts off, dragging after it the date-stick, attached to the rope. The swinging stick makes it impossible for the animal to get away at any pace, as, twisting round one leg or the other, it throws the Gazelle to the ground continually.

The spoor of the trapped Gazelle with the marks of the swinging stick are easily found, and the animal tracked down until in sight, when a trained greyhound will soon catch and hold it until his master comes up.

During November and December the Gazelles are caught when fawns by trained hounds, and this is the simplest method; but it can only be practised during two months, as it takes a very good dog to catch a Gazelle when more than this age.

During the eight days I was in the desert, though unsuccessful in trapping any, I saw several very fine specimens of Loder's Gazelle.

6. On the Type Specimen of *Boulengerina stormsi*, an Elapoid Snake from Central Africa. By G. A. Boulenger, F.R.S.

[Received November 26, 1895.]

(Plate XLVIII.)

In the year 1886 M. L. Dollo established a new genus of Elapoid Snakes which he did me the honour of naming after me *Boulengerina*. The single specimen of *Boulengerina stormsi* formed part of a small collection from Lake Tanganyika, presented to the Brussels Museum by Capt. Storms, an officer in the service of the Congo State. The Snake was described very shortly, and although the type specimen had passed through my hands before, I felt desirous of re-examining it in order to fix its correct position in the system. My friend M. Dollo having, with his usual kindness, entrusted the specimen to me for description, I have much pleasure in bringing it before the notice of the Society.

There can be no doubt the genus is valid, and perhaps more nearly allied to the Australian forms associated under *Hoplocephalus* and *Diemenia* than to any of the African genera. Among the latter, it comes nearest to *Elapsoidea*, which differs in having slightly oblique scales and a very short tail. It differs from *Naia* in the disposition of the scales, which are not oblique, and in the further extension forwards of the palatine bones; from *Walterinnesia* in the latter character, and in the position of the nostril, which is not bordered by the internasal shield.

The genus and species may be defined as follows:—

BOULENGERINA.

Dollo, Bull. Mus. Belg. iv. 1886, p. 159.

Maxillary bone extending forwards as far as the palatine, with a pair of large grooved fangs, followed by three or four small solid teeth; mandibular teeth, anterior longest. Head not distinct from neck; eye small, with round pupil; nostril between two nasals; no loreal. Body cylindrical; scales smooth, without pits, in 21 rows; ventrals rounded. Tail moderate; subcaudals in two rows.

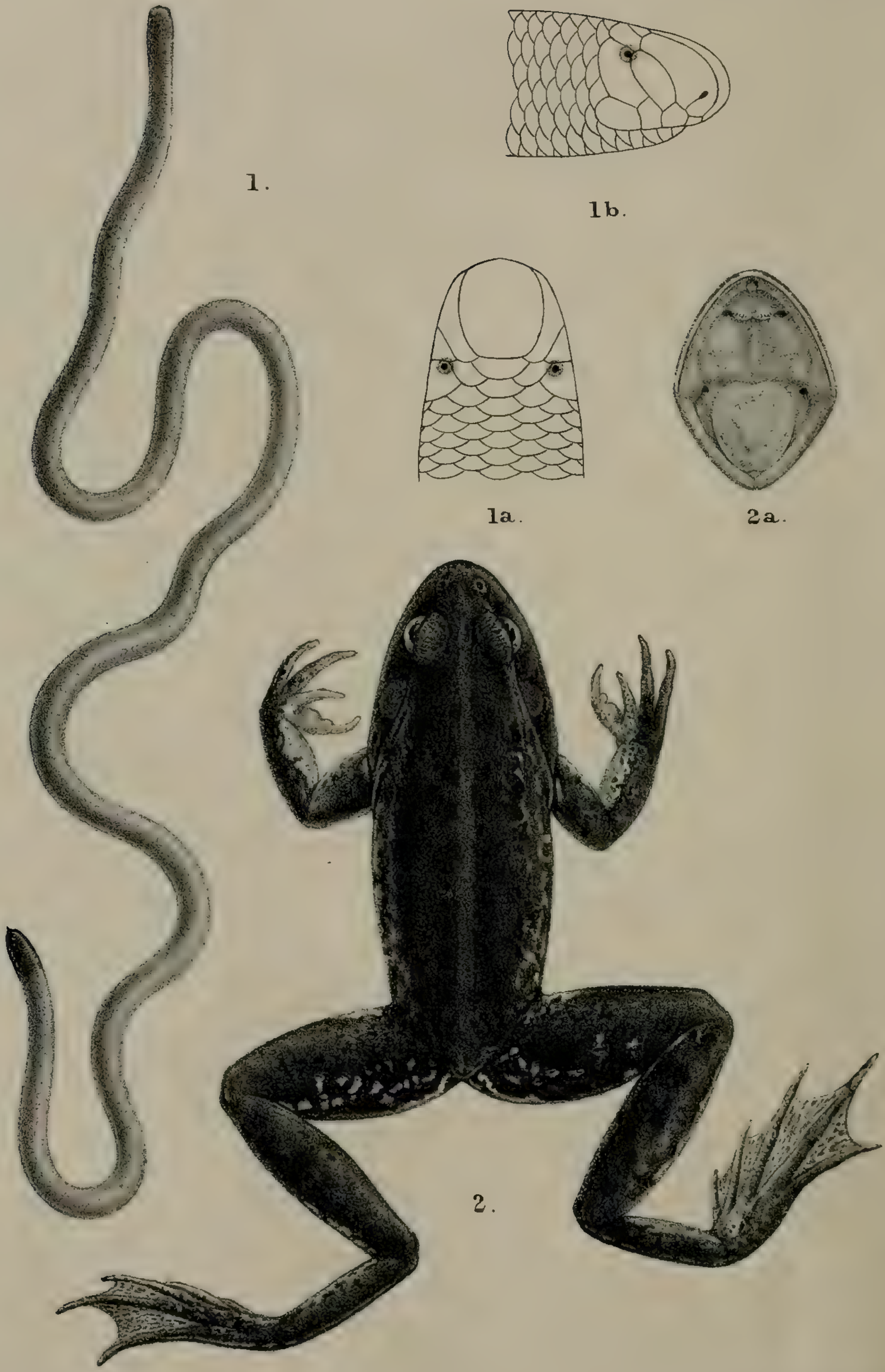
BOULENGERINA STORMSI. (Plate XLVIII.)

Dollo, *l. c.*

Head scarcely depressed; snout rounded, not prominent, without canthus; eye scarcely longer than its distance from the mouth. Rostral nearly as deep as broad, the portion visible from above measuring half its distance from the frontal; internasals shorter and a little broader than the præfrontals, extensively in contact with the præocular; frontal small, slightly longer than broad, as broad as the supraocular, as long as its distance from the rostral, slightly more than half the length of the parietals; posterior nasal in contact with the single præocular; two postoculars; temporals 1+2; seven upper labials, third and fourth entering the eye, fourth, fifth, and sixth in contact with the lower postocular, third and sixth deepest; four lower labials in contact with the anterior chin-shields, which are much longer than the posterior. Scales not oblique, in 21 rows. Ventrals 193; anal entire; subcaudals 67. Brown above; four black cross-bars on the nape and neck, the second and third forming complete rings, followed by five irregular black spots; further back, the body darker brown with the scales black-edged; tail black; belly white anteriorly, brown further back, with the shields black-edged, blackish brown towards the tail.

The specimen measures 240 millim., in which the tail enters for 85. It is young, as indicated by the umbilical fissure; the species therefore reaches a size at least equal to that of the Indian Cobra.

NATURAL HISTORY



J. Green del. et lith.
Mintern Bros. imp.

1. TYPHLOPS NIGRICAUDA. 2. CHIROLEPTES DAHLII.

7. Descriptions of a new Snake and a new Frog from North Australia. By G. A. Boulenger, F.R.S.

[Received November 26, 1895.]

(Plate XLIX.)

The Snake and Frog which I propose to describe form part of a collection made by Dr. Dahl in North Australia, and submitted to me for identification by my friend Prof. Collett. The collection is preserved in the Zoological Museum at Christiania, but I have been allowed to retain duplicates for the British Museum.

Typhlops nigricauda. (Plate XLIX. fig. 1.)

Snout very prominent, rounded; nostrils inferior. Rostral broad, more than half the width of the head, extending to the level of the eyes; nasal incompletely divided, the cleft proceeding from the second labial; præocular present, a little narrower than the nasal or the ocular, in contact with the second and third labials; eyes distinguishable; præfrontal and supraoculars considerably enlarged; four upper labials. Diameter of body 70 to 80 times in total length; tail a little longer than broad, ending in a spine. 18 scales round the body. Brown above, yellowish below; end of snout yellow; tail black.

Total length 315 millim.

Two specimens from the Daly River, North Australia.

Chiroleptes dahlii. (Plate XLIX. fig. 2.)

Physiognomy of *Rana esculenta*. Tongue circular, slightly nicked behind. Vomerine teeth in transverse oval groups between the choanæ. Head as long as broad; snout rounded, slightly longer than the diameter of the orbit, with indistinct canthus and very oblique, slightly concave lores; nostril equally distant from the eye and the end of the snout; interorbital space narrower than the upper eyelid; tympanum very distinct, as large as the eye or a little smaller. Fingers moderate, first longer than second; toes moderate, webbed to the tips; subarticular tubercles very small; a very small oval inner metatarsal tubercle, measuring about one-fourth the length of the inner toe; no outer metatarsal tubercle. The tibio-tarsal articulation reaches the anterior border of the eye. Skin smooth; a fold above the tympanum. Dark olive above, with a paler vertebral streak; a blackish canthal streak; sides of body marbled with black and spotted with white; hinder side of thighs marbled black and white; lower parts white; sides of throat and lower surface of limbs with small blackish spots. Male with internal vocal sacs.

From snout to vent 70 millim.

Two specimens, male and female, from the Daly River, North Australia.

EXPLANATION OF PLATE XLIX.

Fig. 1. *Typhlops nigricauda.*
1 *a.* „ „ Upper view of head, ×6.
1 *b.* „ „ Side view of head, ×6.
2. *Chiroleptes dahlii,* ♂.
2 *a.* „ „ ♂. Open mouth.

December 17, 1895.

Sir W. H. Flower, K.C.B., LL.D., F.R.S., President, in the Chair.

Dr. Donaldson Smith gave an account of some of the animals observed by him during his recent expedition to Lakes Rudolph and Stephanie, and alluded specially to the various species of Zebras and Antelopes which he had encountered during his journey.

Mr. Donaldson Smith's remarks were as follows:—

"Commencing 20 miles east of the Shebeli River, the range of the Grévy's Zebra (*Equus grevii*) extends about 120 miles to the west; it is limited by the second and the eighth degrees of latitude. On passing the Juba River you find Burchell's Zebra (*Equus burchelli*) in great herds among the mountains of the Boran country, but no Grévy's Zebras until Lake Stephanie is reached. Here you find the ranges of the two species overlapping to a slight extent. About Lake Rudolph I met with only Grévy's Zebra. The greatest altitude at which I found it was about 4700 feet.

"I did not see Swayne's Hartebeest (*Bubalis swaynei*) outside the plains of Central Somaliland.

"Coke's Hartebeest (*Bubalis cokii*) occurs on the grassy plateaus north of Lake Stephanie.

"About Lake Rudolph the Topé (*Damaliscus jimela*) is found in great numbers, but no other Hartebeest. I saw one lot of fine Coke's Hartebeest fifty miles north of Lake Rudolph.

"About the river running into Lake Stephanie there is a very light reddish-grey Waterbuck (*Cobus*), of which I have not yet made out the name. I brought back one specimen of it, with horns 29½ in. long. It was 51 in. high at the shoulder.[1] The hair is not so coarse as in the case of other Waterbucks, and there was no dark line behind. There was also a small reddish-grey Antelope, or allied animal, about this same river; it was 42 in. high and had straight horns, except near the point, where they appeared to have a slight backward curve, the horns were about 13 in. long. This was also seen in the hills near water.

"I saw Grant's Gazelle (*Gazella granti*) first in the Boran Country a little west of long. 39° W. They extended as far as lat. 6° N., and were seen in great numbers all along my route to the Tana River.

"Sœmmerring's Gazelle (*Gazella sœmmerringi*) I did not see far beyond the Juba River."

Mr. Sclater called attention to a very fine head of the so-called "Kob" Antelope of Kavirondo and Uganda, belonging to Mr. Ernest Gedge, and lent by him for exhibition. Mr. Gedge had shot the Antelope from which this specimen had been taken at Berkely Bay, on Lake Victoria, when returning from Uganda in 1893.

In Mr. F. J. Jackson's excellent account of the British East

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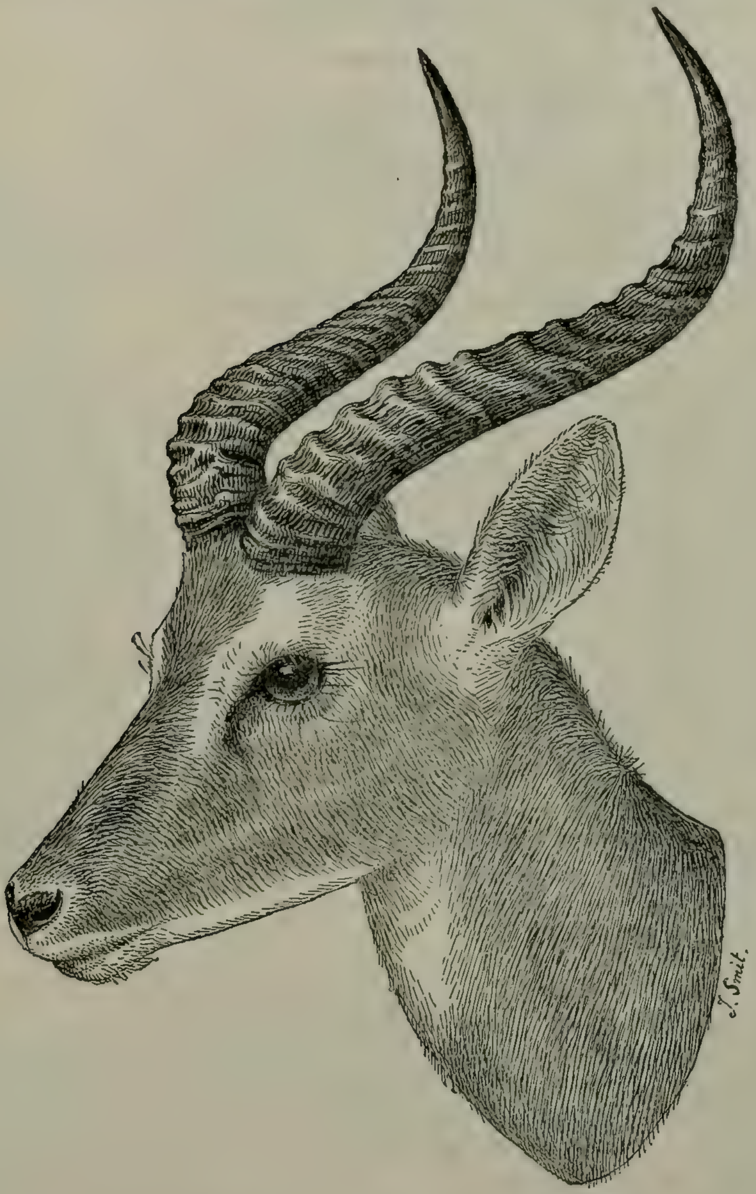
[1] [The specimen, which Dr. Donaldson Smith has kindly allowed me to examine, is referable to *Cobus defassa* (Rüpp.).—P. L. S.]

African Antelopes in the first volume of 'Big Game Shooting,' in the Badminton Library (p. 296), this Antelope had been named "*Kobus kob*," probably from a mounted specimen of it in the British Museum having been so labelled. In Herr Matschie's recently published volume on German-East-African Mammals (p. 126) it had been also referred to the West-African Kob. But Mr. Thomas and Mr. Sclater had quite agreed that this determination was wrong, the West-African Kob being a much smaller animal.



Head of *Cobus thomasi*, ♂. (From Mr. Gedge's specimen.)

When recently examining the specimens of this Antelope in the British Museum, Herr Oscar Neumann had come to the same conclusion, and had affixed to one of them the MS. name *Cobus thomasi*, under which he proposed to describe it.

The future name of the so-called Kob of British East Africa would be therefore *Cobus thomasi*, Neumann.

The following papers were read:—

1. On *Cænolestes*, a still Existing Survivor of the *Epanorthidæ* of Ameghino, and the Representative of a new Family of recent Marsupials. By Oldfield Thomas, F.Z.S.

[Received November 11, 1895.]

(Plate L.)

In the 'Proceedings' of the Society for 1860[1], Mr. R. F. Tomes, in working out a collection of small mammals obtained by Mr. Louis Fraser in Ecuador, published the first notice of the genus which forms the subject of the present paper. He spoke of his specimen as "a small animal about the size of a Water-Shrew," but "having a small and rudimentary pouch," and three years later[2] gave a technical description of it under the name of *Hyracodon fuliginosus*.

This technical description was unfortunately unaccompanied by any remarks on the relationships of the animal, a want which has made itself felt by the entire failure of later authors to make out from the description what animal Mr. Tomes had before him.

In fact I only know of two references to *Hyracodon* at all (those mentioned in the footnote[3]), and in both the authors express their inability to make anything of the description, although the first-named acutely suggested that the animal "might represent a distinct family," a suggestion most fully borne out by an examination of the specimen I now have the honour of bringing before the Society.

In vindication of Mr. Tomes's paper I should like to say, firstly, that his description, hitherto supposed (from our ignorance of any such animal) to be imperfect or incorrect, proves to agree, so far as it goes, very closely with the present specimen; and secondly, that remarks on the affinities of the animal must have been at that date more easily wanted than given, since even now, with infinitely greater material and the best of advice[4], I am unable to be at all

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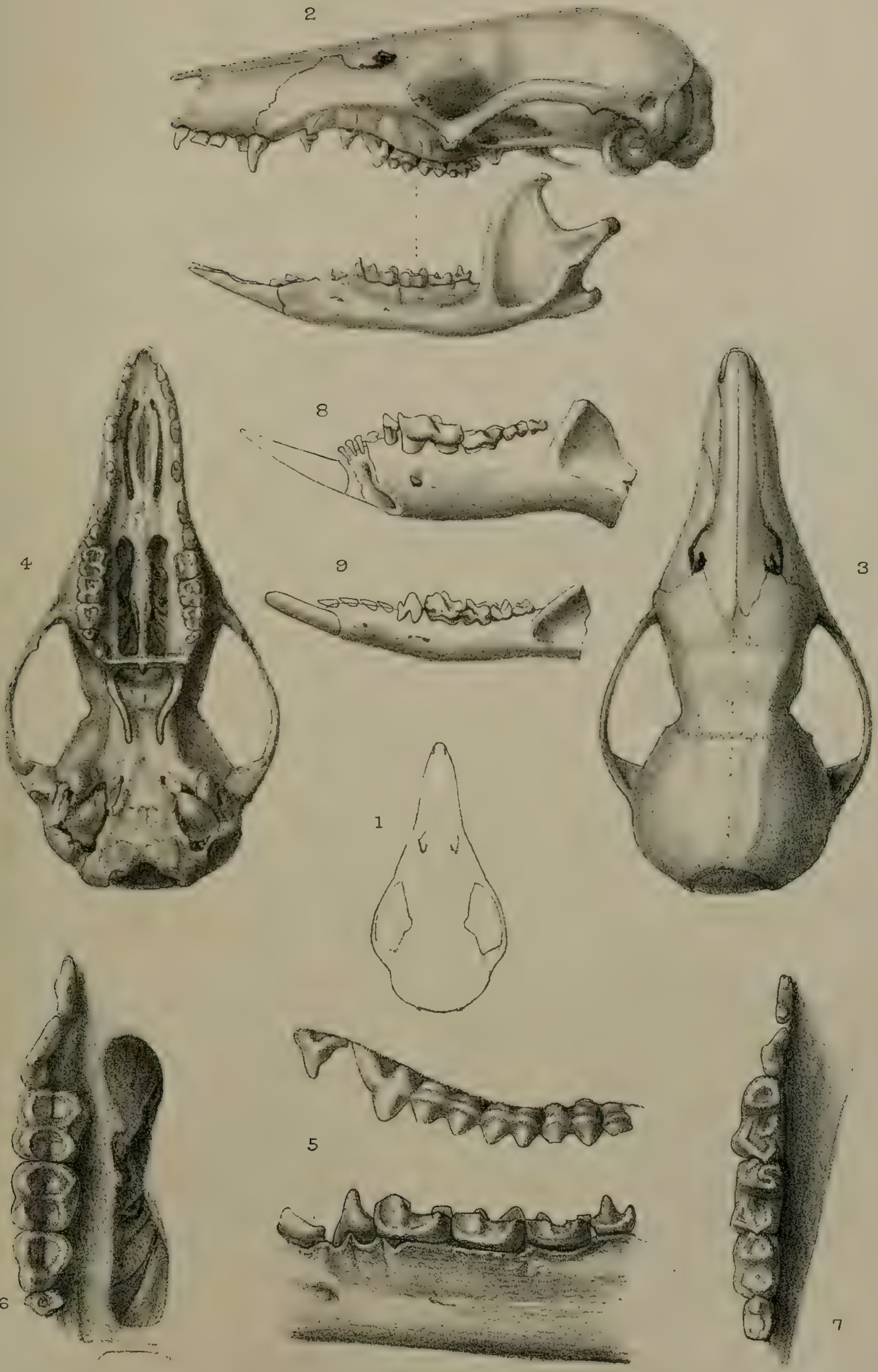
[1] P. Z. S. 1860, p. 213.

[2] P. Z. S. 1863, p. 50, pl. viii. (animal).

[3] Alston, Biol. Centr.-Am., Mamm. p. 195 (footnote), 1880; Thomas, Cat. Mars. B. M. p. 370 (1880).

[4] I would specially mention my indebtedness to Mr. R. Lydekker, whose own extreme interest in the present animal has expressed itself in abundant and most serviceable help to me in working it out.



A.T.Hollick del. et lith.

West, Newman imp.

Cœnolestes obscurus.

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positive about the exact position and relationships of the little marsupial described by Mr. Tomes.

It unfortunately happened that the name given by Mr. Tomes, *Hyracodon*[1], was preoccupied by the Ungulate *Hyracodon* of Leidy[2], so that the genus has now had to be renamed, and I have proposed for it[3] the name *Cænolestes*[4], as it is a modern member of an ancient group of fossil marsupials, among which the affix *-lestes* has been often employed.

The specimen on which the present account is based was obtained near Bogotá by an Indian in the employment of my kind Colombian correspondent Mr. Geo. D. Child, and the latter is to be congratulated on the capture of such a prize. In fact the rediscovery of Tomes's genus, both on account of its having so long been a puzzle to zoologists, and still more on account of the relationship it proves to possess to long extinct fossil forms, I venture to consider one of the most interesting events that have happened in mammalogy for many years.

Comparing it, as one may not unnaturally do, with Dr. Stirling's discovery of *Notoryctes*, also representing an additional family of Marsupials, one sees that while the latter is of surpassing interest to the general zoologist on account of the entire novelty of its structure and its unique adaptation (among Marsupials) to a talpine life, *Cænolestes*, with its uninteresting exterior, appeals mainly to the technical Mammalogist. To him, however, with its intense palæontological and geographical interest, and the added puzzle its structure gives rise to in the general classification of the order, no animal will appear more important or more worthy of close and detailed study.

That by the arrival of spirit-specimens any such admirable account of its anatomy may be rendered possible as the one on *Notoryctes* by Dr. Gadow is very much to be hoped. The present specimen is a skin with a perfect skull. It is an old individual, and the teeth are apparently rather worn, so that for a clear detailed knowledge of their structure we must still wait for further examples. With this exception the following is a description of the genus, so far as the external characters and skull are concerned. To keep the description together and to avoid repetition, I have included both such characters as may possibly prove to be only of specific value and those that are clearly of family rank. A short analysis of them is, however, given later.

It has been found necessary (*l. c.*) to consider the Bogotan example as representing a new species, named *Cænolestes obscurus*, but it is evidently so closely allied to *C. fuliginosus* that for the purposes of this paper, which deals mainly with generic characters, the two have been treated as one. There are, it is true, certain slight differences between Mr. Tomes's description of the teeth of *C. fuliginosus* and those of the type of *C. obscurus*, but whether these differences are due to age or specific distinction cannot be made out without direct comparison.

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[1] I am informed by Mr. Sclater that this name had no reference to *Hyrax* as zoologists know it, *i.e. Procavia*, but to ὕραξ, a shrew, the word therefore most appropriately meaning Shrew-tooth.

[2] Proc. Ac. Philad. viii. p. 91 (1856).

[3] Ann. Mag. N. H. (6) xvi. p. 367 (1895).

[4] *καινὸς*, modern ; ληστὴς, a pirate or other predatory person.

CÆNOLESTES.

General appearance not unlike that of a Rat or small Opossum. External characters very much as in the Dasyurid genus *Phascologale.* Head elongate. Nose naked, both in front and on the top of the muzzle. Ears short, squarish, their inner surfaces provided with several (three in *C. obscurus*) tragoid projections. Fore feet with five toes, of which the outer one, as well as the pollex, has a distinct *nail*, while the middle three digits have each a well-developed curved claw. The third digit is the longest, the second and fourth subequal, about 1 mm. shorter; fifth reaching to the end of the first phalanx of the fourth, first to the middle of the same phalanx of the second. Palms naked, with one elongated carpal pad, three ordinary digital, and one pollical pad. Hind foot of normal shape, not syndactylous, and not modified into a hand as in the Opossums. Hallux short, clawless, not properly opposable[1], its development very much as in *Phascologale wallacei*[2]. Other digits subequal, the fourth slightly the longest; all provided with claws. Soles naked, with 6 pads, situated very much as is shown in the figure of *Phascologale wallacei* just referred to; but all rather more elongated and not transversely striated. Tail long, slender, rat-like; so thinly haired as to appear naked, its terminal inch below wholly naked; it is therefore presumably prehensile. "A small and rudimentary pouch present" (Tomes).

Skull in its general proportions something like that of a *Perameles,* although thinner and more delicately built, with a similarly elongated muzzle, smooth and rounded brain-case, and obsolete supraorbital and cranial crest and ridges; the zygomata are, however, so much more boldly expanded as somewhat to spoil the resemblance, which in any case does not apply to details. Nasals long, thin, anterior two-thirds narrow, almost parallel-sided, but a little tapering forwards, their posterior third well expanded, somewhat as in ordinary *Didelphys*, but not expanded enough to meet the upper edge of the maxillary bone. As a result, an anteorbital vacuity is left on each side in the position of, and formed in exactly the same way as that of, so many Ruminants. Apart from the latter group, this vacuity is perfectly unique among Mammals, and therefore is well worthy of special note.

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[1] Mr. Tomes says "feet furnished with an opposable thumb," but the opposition, at least in *C. obscurus,* is by no means comparable with that of *Didelphys.* In the plate neither pollex nor hallux is shown as opposable, and both they and the fifth digit of the hand are ornamented with long claws, about the presence of which I venture to be somewhat sceptical.

[2] Figured 'Cat. Marsupials,' pl. xxiii. fig. 3.

The vacuity, judging from the spicules of bone which project into it from the nasals, and from its known development in the Ruminants, probably tends to ossify over as life advances, but—the specimen being old—evidently never entirely fills up. Interorbital space broad, smooth and rounded, with scarcely a trace of ridges, ledges, or postorbital processes; lambdoid ridges, however, fairly well developed. Lacrymal canal single, just on the rounded edge of the orbit. Zygomata slender, boldly expanded; malar as usual running back to form part of the glenoid fossa. Palate very imperfect, the anterior foramina reaching from between the third pair of incisors to halfway between the anterior and middle premolars; posterior vacuities extending from the large posterior premolar to behind the last molar, the bridge between their front limit and the back of the anterior foramina only 2·7 mm. across. Pterygoid processes slender and delicate, pointing backwards and inwards, their needle-like ends 1·6 mm. long. Bullæ small, imperfect, transparent, formed as usual by the alisphenoids. Tympanic annular, but imperfect, only forming about three-fourths of a circle.

Dentition. $I. \frac{4}{3}$; $C. \frac{1}{1}$; $P. \frac{3}{3}$; $M. \frac{4}{4} \times 2 = 46$.

Viewed as a whole, the teeth present a considerable resemblance to those of the Australian *Dromicia* (e.g. *D. lepida*, figured Cat. Mars. B. M. pl. xvi. figs. 2–5), especially in their relative proportions.

Upper Jaw.—Incisors four in number; the first vertical, pointed, touching its fellow of the opposite side, but separated from i^2, in fact very similar to its condition in *Didelphys*. I^2 and i^3 flattened laterally, not pointed, but with a straight cutting-edge; i^4 separated from i^3, smaller and rather more pointed[1]. Canines well-developed, as in average carnivorous Marsupials. Anterior and middle premolars small, narrow, two-rooted, sharply pointed, equal in size, the distance between them about equal to that behind the canine. Posterior premolar somewhat similar, but twice as large and rather thicker transversely, with one long main cusp, which stands up just higher than any cusp on the molars, and a small anterior secondary cusp, placed slightly internally. Molars low-crowned, with low rounded or scarcely pointed cusps, not unlike those of *Petaurus* or *Dromicia*; the two anterior square, quadricuspidate, although apparently[2] there are only three roots to each tooth, the postero-internal cusp being placed on a sort of flange overhanging the palate and not supported by a root; third molar similar, but without the extra postero-internal cusp; last molar minute, triangular, as small in cross-section as the last incisor.

Lower Jaw.—Anterior incisor elongated, exactly as in typical

---

[1] On the left side (as shown in Plate L.) this tooth has been displaced and pressed against the front of the canine, but on the right side, which appears to be normal, there is a small diastema.

[2] It is at present impossible to be quite certain as to the number of roots each tooth possesses, as the teeth are so firmly wedged in that without damaging the skull, as yet unique, they cannot be pulled out or their roots developed.

Diprotodonts, its length in front of the jaw-bone exceeding that of the three anterior molars. Succeeding it, just as in the same Australian group, are four minute unicuspid teeth, which it seems best for the present tentatively to call two premolars, one canine and a premolar. Any other determination would involve the presence of four incisors or four premolars, each equally unlikely. Then come two narrow, pointed, two-rooted teeth, obviously premolars, the posterior slightly longer than the anterior, and, as in the upper jaw, just overtopping the molars. Molars low-crowned, more or less oval in section, and each with two roots. Their pattern is difficult to make out accurately, owing to a doubt as to how far they are affected by wear. The anterior ones each seem to have two curved or angular crests, whose concavity is directed inwards, somewhat similar to those of the Indian Rhinoceros, but they are far less distinct; the posterior is larger and more open as compared with the much smaller and less open anterior one, and they are very probably produced in a wholly different way; the anterior crest is decidedly higher than the posterior. The last molar is much smaller than the other, and has two pointed cusps corresponding to the crests of the other teeth; both rather inwards of the middle line.

The following are some dimensions of the specimen described, the type of *C. obscurus*:—

Head and body 151 mm.; tail 144; hind foot without claws 23; heel to end of hallux 14·2; hallux 3·2; ear 12 × 11·5.

Skull—basal length 33·6; greatest length in middle line 36; greatest breadth 18; nasals, length 17·8, greatest breadth, approximately, 5·4; intertemporal breadth 7; breadth of brain-case 12·8; height of brain-case above basilar suture 9; palate, length from gnathion 20·6, breadth outside $\underline{\mathrm{m}^2}$ 8·3, inside $\underline{\mathrm{m}^2}$ 5; anterior palatine foramina 6·2; length of palatal vacuities 7·2; combined length of $\underline{\mathrm{ms.}^{1-3}}$ 5·1. Lower jaw, length from condyle, bone only, 23·8, including $\mathrm{i}^{\overline{1}}$ 28·5; height of coronoid above angle 10; vertical thickness of ramus below m^1 3; length of $\mathrm{i}^{\overline{1}}$ beyond bone above 6; length of lower molar series 6·9.

We may now pass from these necessary, but dry and uninteresting details to the important question as to what Marsupial *Cænolestes* is most nearly allied to, for Marsupial it is in every character. With regard to living members of the order, the answer can only be that it is allied, at least closely, to none, but that, so far as it has any existing relations, these are distinctly the Australian rather than the American Marsupials. For it is clearly a Diprotodont, as not only does it possess the characteristic development of the lower incisors, but even the molars resemble most closely in structure those of certain members of the family *Phalangeridæ*, while being wholly unlike those of the typical Polyprotodonts.

From all of the existing Diprotodonts, however, apart from its habitat and numerous detailed differences, *Cænolestes* is at once distinguished by its not being syndactylous, a character which is always considered as of family rank. It forms, therefore, among existing Marsupials a peculiar Family, and one which in America represents the Diprotodonts of Australia, just as the *Didelphyidæ* do the Polyprotodonts.

But turning to extinct Marsupials, the allies of *Cænolestes* are readily found. For among the large numbers of fossils from the Santa Cruz beds of Patagonia described during the last few years by Señor Florentino Ameghino, of La Plata, there are some which so closely resemble *Cænolestes* that no one can have the slightest doubt as to their being really related to it.

These are the *Epanorthidæ* and *Decastidæ* of Ameghino, and, rather farther removed, the *Abderitidæ* of the same author. The last-named have a hypertrophied trenchant last lower premolar, and may for the present be put on one side. The other two, however, which contain, according to their describer, some 13 genera in all, show a dentition which cannot be distinguished from that of *Cænolestes* in any character of family importance. Indeed, I fail, no doubt from only having descriptions and figures instead of actual specimens, to understand why Señor Ameghino distinguishes them from each other. But as the earliest named family, the *Epanorthidæ*, contains some of the forms most closely allied to *Cænolestes*, we may safely ignore for the present the *Decastidæ*, and speak of the fossil allies of *Cænolestes* simply as *Epanorthidæ*.

Further, after a careful examination of the characters of the different fossil genera, I am prepared to say that *Cænolestes* is not only allied to, but actually falls into the Family, so that the name *Epanorthidæ* must be used for its recent as well as fossil members.

The best account of the fossil *Epanorthidæ* is contained in a paper by Ameghino [1], published in 1893, and giving a full list of all the genera and species described up to that date, with woodcuts of many of their jaws and teeth. Of these woodcuts I have ventured to copy two (see Pl. L. figs. 8 & 9), those of the lower jaws of *Decastis columnaris* (p. 341) and *Parepanorthus minutus* (p. 350), which will show the exceedingly close alliance of *Cænolestes* with those long-extinct Patagonian Marsupials.

Again, in the figures of *Epanorthidæ* given on plate i. of the same author's fine work of 1889 [2], several agree very closely with *Cænolestes*, notably the upper molar of *Epanorthus lemoinei*, drawn fig. 14, which shows very well the quadricuspid three-rooted character of the upper molars of *Cænolestes*.

The exact geological age of the beds in which *Epanorthus* and its fossil allies have been found is still under discussion, and I do not venture to express an opinion on the subject. Ameghino has called them Middle Eocene, Lydekker Oligocene or early Miocene. Further surveys will no doubt some day settle the point, but it is difficult to believe that the beds are quite so early as Señor Ameghino supposes.

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[1] "Énumération synoptique des espèces de Mammifères fossiles des formations éocènes de Patagonie," Bol. Ac. Cordoba, xiii. p. 259 (1893).

[2] 'Mamiferos fósiles de la República Argentina.' Text and Atlas, fol.

Any lingering doubt which may have existed among Naturalists as to the correctness of Ameghino's reference of the *Epanorthidæ* to the Marsupials (and doubt has been thrown on it) is wholly removed by the study of *Cœnolestes*, which is typically Marsupial in every character.

As to the general classification of the Marsupials, a subject already sufficiently difficult in view of the puzzling possession by the *Peramelidæ* of polyprotodonty combined with syndactyly, *Cœnolestes* apparently only adds to the difficulty, being non-syndactylous like most Polyprotodonts, while it has by dentition nothing to do with them. If anything, however, this fact tends to confirm the tentative opinion expressed in the 'Catalogue of Marsupials,' p. 220, that the primary division of the order should be by dentition, and that syndactyly is a secondary character. Were syndactyly the primary character, the *Epanorthidæ* would be thrown with the *Dasyuridæ* and *Didelphyidæ*, with which they clearly have nothing whatever to do, and separated from what appear to be their nearest allies, the *Phalangeridæ*.

If this view be correct, the Marsupials as a whole might be divided as follows:—

Order MARSUPIALIA.
- I. Suborder DIPROTODONTA.
  - A. *Non-syndactylous.*—American.
    - 1. Epanorthidæ.
  - B. *Syndactylous.*—Australian.
    - 2. Phalangeridæ.
    - 3. Phascolomyidæ.
    - 4. Macropodidæ.
- II. Suborder POLYPROTODONTA.
  - A. *Syndactylous.*—Australian.
    - 5. Peramelidæ.
  - B. *Non-syndactylous.*—American and Australian.
    - 6. Didelphyidæ.
    - 7. Dasyuridæ.
    - 8. Notoryctidæ.

It is, however, possible that, in spite of the resemblance of the teeth of *Cœnolestes* to those of certain Australian Diprotodonts, the study of further material, including soft parts, skeleton, and milk-teeth, will bring out differences of such importance as to necessitate its subordinal separation from them. In this case the name suggested by Ameghino, Paucituberculata, will be available for the suborder containing *Cœnolestes* and its fossil allies.

Even in that case, however, in view of their many resemblances, it does not seem possible that anything will show that there is no relationship at all (and only a parallelism) between the American *Epanorthidæ* and the Australian *Phalangeridæ*. The fact, therefore, that no forms at all similar have been found in any part of the Northern Hemisphere, while, with their headquarters in Australia, Diprotodonts have existed in South America at least since early Miocene times, is undeniably very much in favour of the views of those who advocate a former southern connection between Australia and S. America. So long as the *Didelphyidæ* were the only South-American Marsupials known, there was no evidence from the Mammals in favour of, or against, the Southern Continent theory, for Opossums occur fossil half round the Northern Hemisphere, and are, perhaps, merely recent immigrants into S. America. But of late years the strictly Dasyurine relationship of some of the Santa Cruz Polyprotodonts (e. g. *Prothylacinus*) has been recognized, and now to add to this comes the proof that the Patagonian Diprotodonts are really related to the Australian ones; and as both of these groups are in South America of undeniably ancient date, and wholly unknown in any part of the Northern Hemisphere, the case assumes quite a different aspect, and opponents of the theory will probably find it a very difficult matter to explain away the presence of such typically Australian animals in South America.

The systematic information derived from the specimen under examination may be tabulated as follows:—

Order MARSUPIALIA.

Suborder DIPROTODONTA.

Family EPANORTHIDÆ.

Non-syndactylous. Hallux present; not widely opposable.

Incisors $\frac{4}{3}$ (in the recent genus). Lower posterior premolar not hypertrophied.

Genus CÆNOLESTES.

Form as in *Phascologale*. Fifth fore-finger with a nail instead of a claw. Tail long, more or less prehensile. Rudimentary pouch present.

Ante-orbital vacuities present. Palate very imperfect. Premolars $\frac{3}{3}$, the two posterior below large and functional.

1. CÆNOLESTES FULIGINOSUS (Tomes).

Size of a Water-Shrew.
Hab. Ecuador (*L. Fraser*).

2. CÆNOLESTES OBSCURUS, Thos.

Size of a small Rat.
Hab. Bogotá (*G. D. Child*).

P.S., Dec. 31, 1895.—The following remarks on *Cænolestes obscurus* have just been received from Mr. Child:—

"The little animal you speak of is called 'Raton Runcho,' which means 'Opossum-Rat.' It lives in the high brush-wood, and is supposed to feed on birds' eggs and small birds. It is very rare indeed, and is obtained with much difficulty."

EXPLANATION OF PLATE L.

Fig. 1.	*Cænolestes obscurus.*	Outline of skull; natural size.
2, 3, 4.	,, ,,	Side, upper, and lower views of skull, twice natural size.
5.	,, ,,	Cheek-teeth, side view; magnified 5 times.
6.	,, ,,	Upper teeth and half palate. do.
7.	,, ,,	Lower do. do.
8.	*Decastis columnaris.*	Left ramus, lower jaw (after Ameghino).
9.	*Parepanorthus minutus.*	do. do.

2. On the Sensory and Ampullary Canals of *Chimæra*. By Walter E. Collinge, F.Z.S., Assistant Lecturer and Demonstrator in Zoology and Comparative Anatomy, Mason College, Birmingham.

[Received November 14, 1895.]

(Plates LI.–LIII.)

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I. Introductory.

Previous references to either the sensory and ampullary canals or cranial nerves of *Chimæra* are few. There are a number of papers—all more or less imperfect—dealing with the central nervous system, dating from Valentin's studies of 1842. Stannius (**17**) in 1849 described and figured in his classical work the cranial nerves of *Callorhynchus*, a genus closely allied to *Chimæra*. There are also brief references in the text-books of Huxley, Gegenbaur, Wiedersheim, and others. The earliest reference to the canal-system is that given by Leydig (**12**) in 1851. Hubrecht (**11**),

Fig. 1.

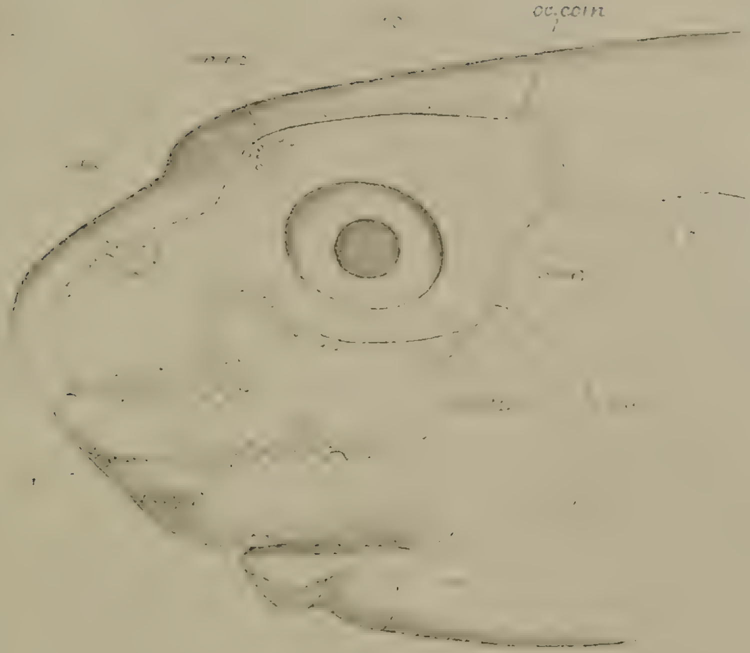


Fig. 2.

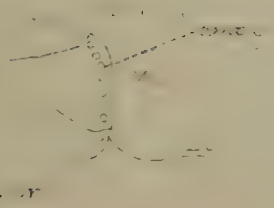


Fig. 4.

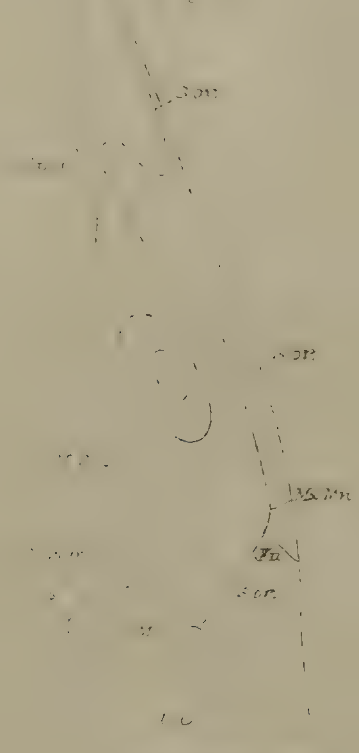
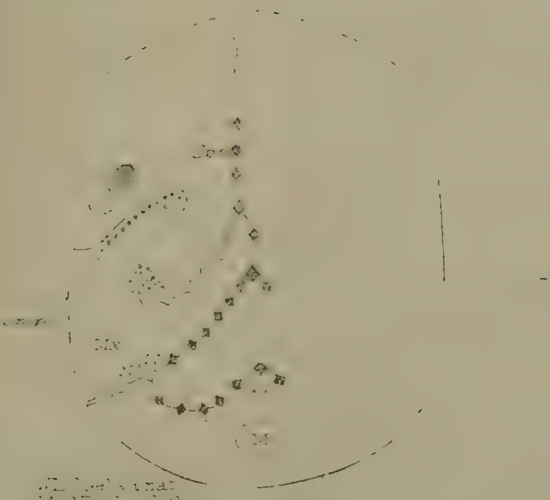


Fig. 3.

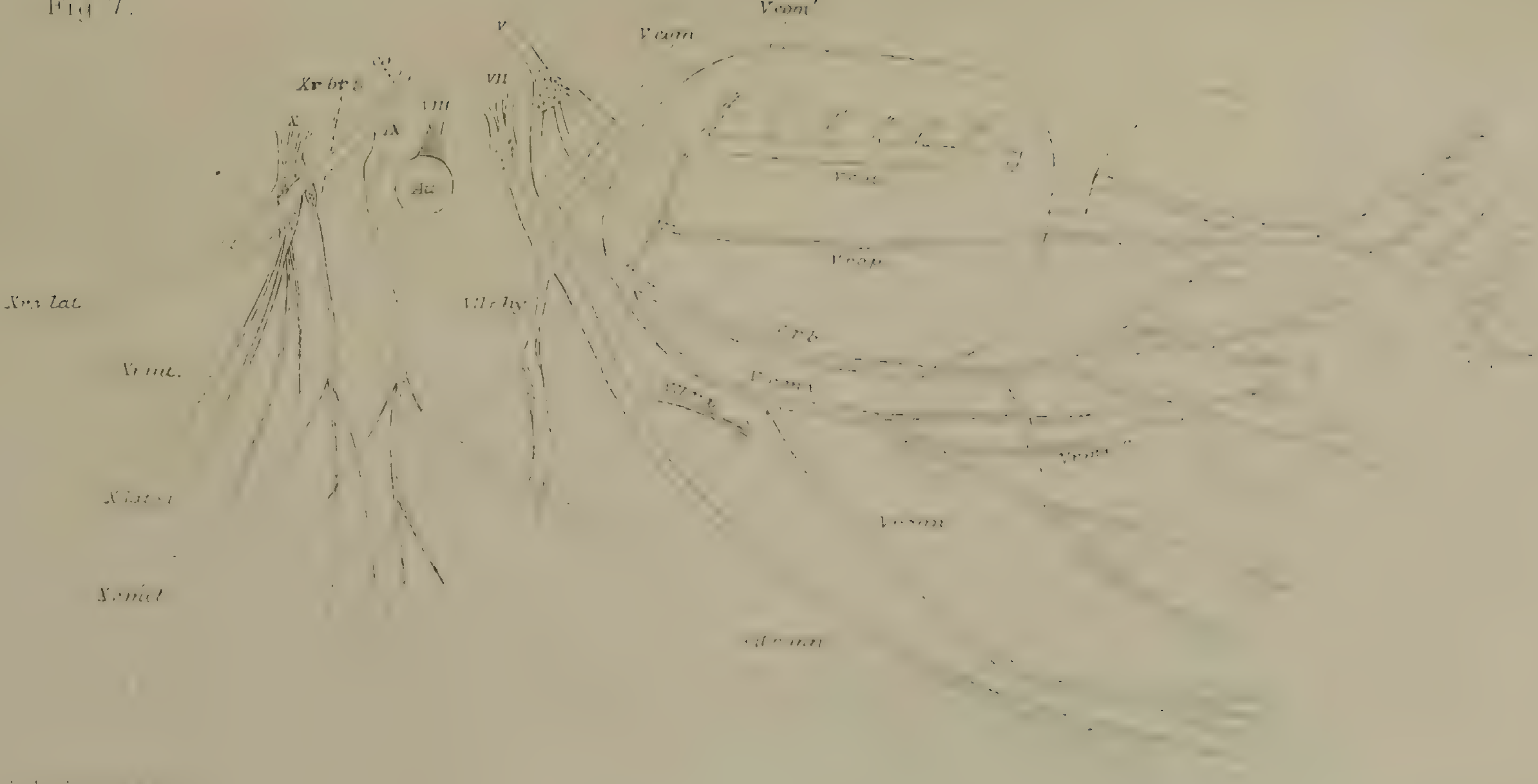


[illegible] del. et nat.
[illegible] Parker lith.

West Newman imp.

Sensory & ampullary canals of Chimaera.

Fig. 7.



W.E. Collinge ad nat. del.
M.P. Parker lith.

West Newman imp.

Sensory & ampullary canals of Chimæra.

NATURAL HISTORY

Fig 8.

Fig 9.

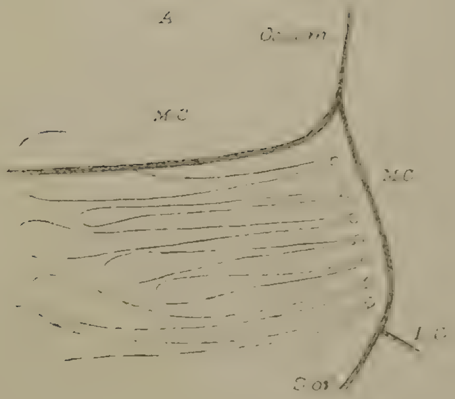


Fig 6.

Fig.11

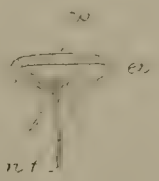
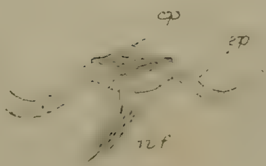


Fig.10



W.E.C. del. ad nat.
M.P. Parker lith.

West, Newman imp.

Sensory & ampullary canals of Chimæra.

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1876, mentions both the canals and cranial nerves in his paper on the skull of the *Holocephali.* Solger (**15**) in 1881 published an account of the development and minute structure of the canals; and later Garman (**9**) described and figured their distribution in both *Chimæra* and *Callorhynchus.*

It was originally my intention to describe at some length the cranial nerves, but lack of better material has prevented me. In the ordinary spirit-preserved material the nerves are not in a fit condition for histological work, and it is only with difficulty that the distribution of the smaller nerves can be traced.

The material was purchased from the Zoological Station at Naples out of funds granted by the Council of the Royal Society, and I take this opportunity of expressing my thanks and acknowledging the assistance they have given me.

My thanks are due to Professor T. W. Bridge, M.A., for his very kind assistance throughout the work, and to Mr. G. A. Boulenger, F.R.S., for his kindness in permitting me to examine the series of young *Chimæra* and *Callorhynchus* in the British Museum collections.

II. The Sensory Canal-System.

1. *General Description.*

In describing the canals and branches I have not adopted the nomenclature of Garman (**9**), as they may be grouped into a similar series as in other fishes, and further, such a nomenclature lends itself better for purposes of comparison. I have given below, on the left side the nomenclature used in this paper, and on the right that used by Garman.

Lateral Canal = Lateral Canal.
Main Canal of the Head = The Cranial Canal (part).
The Occipital Commissure = Aural and Occipital Canals.
The Supra-orbital Branch = The Rostral Canal.
The Sub-orbital Branch = The Orbital and Sub-orbital Canals.
The Maxillo-mandibular Branch = The Angular, Nasal, and Oral Canals.

The lateral canal commences at the end of the long whip-like tail on the lower edge of the muscles, and passes forwards as an open groove to the region of the head, where it is continued as the main canal of the head. This passes forwards forming the supra-orbital branch and in the anterior region joins with the sub-orbital and maxillary branches. Dorsally an occipital commissure is given off from the main canal, and ventrally the sub-orbital branch. From the angle of the sub-orbital branch a short branch is given off—possibly homologous with the operculo-mandibular branch of Ganoids and Teleosts and the hyomandibular branch of Elasmobranchs—which divides into maxillary and mandibular branches; previous to this division there is a short backwardly directed branch, the "jugular canal" of Garman. The maxillo-mandibular branch divides into maxillary and mandibular divisions; anteriorly the former division meets with the sub-orbital branch, previous to which, however, it gives off a ventral flexure. No short or dendritic branches are given off from either the lateral or main canals or the larger branches. There is also an absence of primitive pores, and the cluster-pores are very few in number. In certain parts of the canals of the head there are large diamond-shaped openings. In these regions the canal is distinctly larger and is supported and protected by a series of cartilages.

2. *Course of the Canals and Branches.*

1. THE LATERAL CANAL commences a few millimetres from the end of the long whip-like prolongation of the tail. Its course lies on the lower side of the muscles of the trunk. Rising slightly dorsally, it passes on to the sides of the body and continues forwards as an open groove to the region of the head. There are no branches of any description passing off from the lateral canal, a feature so characteristic of many Elasmobranchs.

2. THE MAIN CANAL OF THE HEAD passes directly dorsally, giving off an occipital commissure, and then passing forwards and slightly inwards. Where the main and lateral canals meet with the sub-orbital branch, in some of the specimens examined a small forwardly directed branch was given off (Pl. LI. fig. 2, *x.*).

The Supra-orbital Branch commences where the main canal of the head turns as a forward and slightly outward branch. It passes above the orbit to the tip of the snout, and then makes a sharp turn and meets with the sub-orbital branch (Pl. LI. fig. 1, *Sp.o.*).

The Sub-orbital Branch leaves the main canal of the head at its commencement and passes ventrally, giving off a short jugular branch, and immediately in front of this the maxillo-mandibular branch. The sub-orbital branch continues forwards making a somewhat **S**-shaped curve and meets with the supra-orbital branch. At the point where these two branches become connected there is a **Y**-shaped commissure connecting the supra- and sub-orbital branches of either side of the head with the maxillary division of the maxillo-mandibular branch (Pl. LI. fig. 1, *S.or.*).

The Maxillo-mandibular Branch is given off from the sub-orbital branch. The maxillary division passes above the upper jaw, meeting with its fellow of the opposite side. It also gives off dorsal to this, on either side, a short branch which meets with the base of the **Y**-shaped commissure previously described (Pl. LI. fig. 1, *Mx.* & *Mn.*).

The mandibular and jugular branches are evidently subject to much variation. In most of the specimens I have examined the former do not meet at the symphysis, but terminate at either side of the mouth; in others there is an interrupted canal, as figured by Garman (9. pl. ii. fig. 5). The jugular branch this author figures as passing backwards to the region of the pectoral fin, where it makes a sharp inward curve and runs as an interrupted canal across the throat, some distance behind the mandibular branch. In all the specimens I have examined this branch runs ventrally and backwards and then forwards, some distance from the region of the fin, in fact quite close to the mandibular branch. This condition was also common to the young examples.

3. THE OCCIPITAL COMMISSURE passes from the upward portion of the main canal of the head and has a slight backward flexure. Where the two sides meet there is sometimes a short median backwardly directed branch (Pl. LI. fig. 4, *Oc.com.*).

All previous authors are agreed as to the open-grooved nature of the canals in *Chimæra*, as distinct from the tubes found in *Callorhynchus*, and yet the canals do not always persist as open grooves in *Chimæra* or as closed tubes in *Callorhynchus*. In young examples of the former the canals are practically identical with those found in the adult; but in two adult specimens which I examined I noticed a portion of the lateral canal formed a perfect tube, previous to its connection with the main canal of the head, for a distance of about 27 millimetres. In the second specimen the upper portion of the sub-orbital branch was closed for about 12 millimetres. In neither case were there any signs of fusion, so that it is probable that the borders of the groove coalesced in a very early stage, or possibly they arose as distinct isolated tubes and became united with the open groove later, as the isolated portions of the canal do in more specialized fishes. In each case a fine wire was passed through the tube and then a larger one, in order to stretch it before it was finally cut through. In young specimens of *Callorhynchus* short portions of the lateral canal occasionally appear as grooves, the borders of which coalesce at a later stage and form distinct tubes.

3. *Structure and Histology of the Canals.*

The minute structure of the canals and sensory organs is very similar to that described in other fishes—e. g. *Læmargus* and *Raia*, Ewart (**6** & **7**); *Amia*, Allis (**1**); *Polyodon* (**3**),—as a reference to the transverse section of the lateral canal will show (Pl. LI. fig. 5).

In certain portions of the canal-system, viz., the supra- and sub-orbital branches and the maxillary division of the maxillo-mandibular branch, there are a series of diamond-shaped openings, and where these are present the canals are deeper and considerably wider. Encircling these portions are a series of small cartilages having the form of a broken hoop, the two broken ends terminating as bulbous enlargements. Leydig (**12**) mentions that these cartilages often terminate in dendritic branches, but I have not observed this condition in any of the specimens I have examined, in fact little or no variation was noted in either their size or appearance. They measure 6 millim. in circumference and 1 millim. in breadth (Pl. LIII. fig. 6).

Solger (**15**) has carefully described the histology and certain modifications of the canals and sense-organs.

4. *Innervation.*

In view of recent researches upon the innervation of the sensory canal-system in fishes, the results obtained in *Chimæra* are exceedingly interesting and quite unlike what I expected.

Until quite recently it was generally assumed that the innervation of the sensory canal-system in fishes proceeded from the trigeminal group of nerves. Ewart (**6** & **7**), who was the first to carefully investigate this matter in the Elasmobranchii, has shown that the whole system is innervated by the facial complex, ramus oticus and vagus, "the fifth taking no part in innervating the canals." In the Ganoidei, Allis (**1**) and others have shown that this innervation still obtains, supplemented in *Polyodon* (**3**) by the trigeminal. In the Teleostei (**5**) the facial is almost entirely replaced by the trigeminal group; and, judging from comparative smallness of the branches of the facial in *Protopterus* (**13**) and *Lepidosiren*, we may safely assume that the fifth also innervates the canals in the Dipnoi.

From the nature of the skeleton, the fact that the sensory canals persisted as open grooves, and the presence of ampullary canals, in all three features showing a close affinity with the Elasmobranchs, I expected to find an innervation solely from the facial; but the condition which actually exists is just the reverse, for we find an enormous development of the branches of the trigeminal nerve, particularly of the ramus ophthalmicus superficialis and profundus and ramus buccalis.

Before describing the distribution of the nerves I would point out that Stannius (**17**), as early as 1849, stated that in *Callorhynchus* certain parts of the canals were innervated by the ramus buccalis and ramus maxillaris superior of the fifth nerve.

The Trigeminal Group consists of the following main branches:—

1. The ramus ophthalmicus superficialis.
2. The ramus ophthalmicus profundus.
3. The ramus buccalis.
4. The ramus maxillaris.
5. The ramus mandibularis.

1. *The ramus ophthalmicus superficialis* is the most dorsal and anterior branch. Previous to entering the orbit it joins with the facial by a commissure (Pl. LII. fig. 7, V. *com.*), and some little distance in front of this joins with the branch which on entering the orbit divides into the ramus buccalis and ramus maxillaris. The superficialis passes across the orbit and through a foramen at the opposite side. In its course across the orbit it gives off six dorsal branches.

2. *The ramus ophthalmicus profundus* passes beneath the two commissures referred to above and below the superficialis. Anterior to the orbit both superficialis and profundus anastomose and then break up into a multitude of fine branches, which innervate the supra-orbital branch of the main sensory canal of the head. (Pl. LII. fig. 7.)

3. *The ramus buccalis* passes over the ventral border of the orbit, and, anterior and slightly ventral to it, anastomoses with the ramus maxillaris superior. (Pl. LII. fig. 7, V. *r.b.*)

4. *The ramus maxillaris* passes slightly beneath the orbit as the ramus maxillo-mandibularis. It divides into maxillary and mandibular branches, and the former again into the ramus maxillaris superior and ramus maxillaris inferior (Pl. LII. fig. 7, V. *r.mx.s.* & V. *r.mx.i.*) The ramus maxillaris, as previously pointed out, anastomoses with the buccalis, the combined branches innervating the sub-orbital branch and Y-shaped commissure of the main sensory canal of the head, while the ramus maxillaris inferior innervates the maxillo-mandibular branch.

5. *The ramus mandibularis* branches from the ramus maxillo-mandibularis previously mentioned, passing above and anterior to the foramen through which the ramus palatinus of the facial passes. It breaks up into a series of fine branches, which innervate the mandibular division of the maxillo-mandibular branch of the main sensory canal.

The Facial Group.—With the exception of the ramus hyoideus, which innervates the jugular canal of Garman, no branches of the facial enter into the innervation of the sensory canal-system. Before passing into the orbit the facial is joined by a commissure from the trigeminal. (Pl. LII. fig. 7, V. *com.*)

The Glossopharyngeal nerve arises in front of the Vagus group and passes behind the auditory capsule, ventral to which it divides into three branches. The most anterior runs beneath the ramus hyoideus of the facial and divides up into a series of fine branches, the middle branch passes to the hyoidean gill-cleft, and the posterior branch skirts the border of the pectoral fin. (Pl. LII. fig. 7, IX.)

Gegenbaur (**10.** p. 518) states that the glossopharyngeal nerve "leaves the cranial cavity in company with the vagus." I cannot corroborate this statement, as it is very distinct from the vagus, and as I have shown (Pl. LIII. fig. 8, IX.) leaves the cranial cavity by a separate foramen. To be quite certain of this I have made four independent dissections, all of which agree with the above description. Since these were finished, I find that Hubrecht (**11**) also comes to a similar conclusion. It seems hardly possible that Gegenbaur could have confounded the branch of the vagus X. *br.* 3 (Pl. LII. fig. 7) with the ninth nerve, and yet this latter is so distinct that it is difficult to see how he could have described it as quoted above.

The Vagus arises by a series of branches (Pl. LII. fig. 7), all of which more or less merge into one in the vagus ganglion. The only portion innervating the sensory canal-system is the vagi lateralis.

The vagi lateralis is the largest branch passing from the vagus ganglion, and is formed by the vagi lateralis proper and a commissure from the facial (?). Superficially this commissure arises about 5 millim. posterior to the roots of the facial. I was unable in the material at my disposal to cut sections so as to definitely settle its exact relations to the facial. A commissural connection between the trigeminal and vagus is present in *Ceratodus* (*cf.* Sanders, **14**), in *Lepidosiren* (?)[1], and between the facial and vagus in *Protopterus* (*cf.* Pinkus, **13**). The commissure does not join the ganglion but the ramus vagi lateralis at its commencement slightly beyond the ganglion, as in *Ceratodus*, after which it passes beneath the muscles lying close to, and parallel with, the vertebral column (a feature common to *Lepidosiren* also) at the side of the centra and dorsal to the spinal nerves. It passes backwards to almost the end of the whip-like prolongation of the tail, becoming smaller posteriorly. Fine branches pass off ventrally at intervals, the distance varying from five to twelve millimetres—each branch making a ventral curve and passing dorsally again to the lateral canal, there breaking up into a series of fine fibres.

The remaining branches of the vagus are not concerned with the sensory canal-system and call for no special mention.

III. The Ampullary Canals.

1. *General Description.*

One of the most interesting features in *Chimæra* is the presence of groups of Ampullary Canals. They were first described in this fish by Leydig (**12**).

There are in *Chimæra* five main groups on either side of the head, which from their position and for reference may be termed respectively:—

1. *The Occipital group*, situated anterior to that portion of the main canal which leads to the occipital commissure.
2. *The Median group*, a series lying on either side of the mid-dorsal line of the head.
3. *The posterior and anterior Supra-orbital group*, situated below the supra-orbital branch of the main sensory canal of the head.
4. *The posterior and anterior Sub-orbital group*, situated below and above, respectively, the sub-orbital branch of the main canal of the head.
5. *The posterior and anterior Maxillo-mandibular group*, situated above the maxillo-mandibular branch of the main canal of the head.

The posterior and anterior groups of the supra- and sub-orbital groups are often continuous and in some cases one or both were absent, on either one or both sides of the head; in such cases there were slight differences in the branching of the nerve (*cf.* 4) The position of these canals is by no means so constant as in the Elasmobranchs, and isolated lines or clusters are frequently found in other positions than those noted above. They are always distinct from the sensory canal-system.

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[1] From the examination I have made of *Lepidosiren* I could not positively say whether this commissure arises from the trigeminal or facial, but, from its position outside the cranial cavity, I think the former.

In all the Elasmobranchs yet investigated the ampullary canals are simple unbranched tubes opening into one or more dilated sacculations; indeed it has been generally acknowledged that this unbranched condition was one of their chief characteristics [1].

Leydig (**12**. p. 253) says:—"Die fragliche zweite Art der Schleimkanäle erscheint unter der Form zahlreicher, häutiger Röhren, deren eines Ende blind geendigt und mit einem Nervenzweig versorgt ist, und deren anderes Ende mit rundlicher Oeffnung auf der Haut ausmündet. Rücksichtlich des weiteren Baues und der Lage is Folgendes anzugeben. Man kann an jedem solchen Schleimkanal unterscheiden (1) die Ampulle oder das blinde Ende, und (2) die Röhre bis zu ihrer Ausmündung. Die Ampulle (Fig. 1 *a*) stellt im Allgemeinen eine blasenförmige Erweiterung des blinden Endes der Röhre dar. Sie ist breiter als die Röhre, hat bis zu zwei Linien Umfang und lässt schon für das freie Auge ein gebücktetes Aussehen erkennen. Der Raum der Ampulle ist noch dadurch vergrössert, dass sie sich in fünf zipfelförmige Aussackungen (Fig. 1 *b*) forsetzt, welche nach unten und innen convergiren. Die Zipfel, von beiläufig dreieckiger Gestalt mit gleichfalls blasig erweiterten Ecken, kommen vom seitlichen Rande der Ampulle und überragen den Boden derselben. Ihr Gewebe ist eine helle Bindesubstanz, welche nach innen mehr homogen, nach aussen mehr faserig sich zeigt. Ein helles, aus rundlichen Zellen zusammengesetztes Epitel überzieht die innere Oberfläche. An die Ampulle herantritt ein Nervenstammchen (Fig. 1 *c*), das ungefähr zwölf Primitivfasern zählt, sie durchsetzen die Ampulle an ihrem von den Zipfeln überragten blinden Boden, weichen strahlig auseinander und lassen, da der Boden der Ampulle breit und hell ist, Theilungen der Nervenfibrillen in zwei und drei Aeste häufig und schön sehen. Ueber ihr weiteres Verhalten habe ich nur so viel ermitteln können, dass sie nach und nach feiner geworden, sich in die Zellenmasse der Ampulle und ihrer Aussackungen verlieren." Further histological detail follows and then an account of the contents of the canals. "Noch ist zu bemerken," continues Leydig, "dass die Röhre gewöhnlich gegen ihre Ausmündung hin ihren Durchmesser vergrössert und bis zu zwei Linien weit wird." This statement I have been unable to verify, for I find all the canals become smaller as they approach the pore.

The position and relations of the Ampullary canals to the Sensory canals is noted, and the histology of the capsule enclosing the groups of ampullæ described as follows:—

"Die Ampullen aber sind zu ihrem Schutze in eine eigene Kapsel eingeschlossen, welche in der Mitte der kegelförmig vorspringenden Schnauze liegt und hauptsächlich deren starke Hervorragung bedingt. Die Kapsel hat eine konische Gestalt, ist gegen 1½ Zoll hoch und 1 Zoll breit, ihre Wand ist gitterförmig durchbrochen und besteht aus Bindegewebe, dem nur vereinzelte elastische Fasern beigemischt sind. Mitten durch die Kapsel geht noch ein weisser, aus Bindegewebe gefertigter, 1½ Linien dicker, fester Strang, der von einem knorpeligen Fortsatz des Kopfknorpels kommt und zur Befestigung und Erhaltung der Form der Kapsel wesentlich beiträgt. Die bezeichnete Kapsel ist angefüllt mit einer hellen Gallertmasse, und in diese eingebettet liegen die Ampullen der Schleimkanäle. In der Gallertmasse sieht man ausser Kernen noch Bindegewebsmaschen und elastische, oft in weiten Bogen isolirt verlaufende Fasern, welche alle sowohl mit der Wand der Ampullenkapsel als auch mit den Ampullen selber in Verbindung stehen, und die Befestigung derselben innerhalb der Gallerte sichern."

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[1] Ewart (**6**. p. 60) says, "These radiating canals, however, though often running for a considerable distance side by side, never communicate with each other, nor do they give off tubules or branches."

2. *Structure and Varieties.*

I have quoted Leydig at some length, for his account is the first and only one that makes any pretence at detail. Judging from Leydig's description and figure, he only met with one form of canal, whereas there are three distinct types.

In the occipital group the number of pores varies from seven to eleven, each leads into a long tube or canal which widens out into a sac-like base (Pl. LIII. fig. 9, *a*), the ampulla being ill-defined. In some cases where the pores of the canals are in a row and the canals or tubes run parallel to each other, some are longer than others, the length from the pore to the base of the canal varying as follows:—

Specimen	No. 1. millim.	No. 2. millim.	No. 3. millim.	No. 4. millim.
Pore 1	37	35	34	30
„ 2	25	22	20	18
„ 3	34	30	20	29
„ 4	25	21	28	18
„ 5	20	18	18	29
„ 6	30	29	28	20
„ 7	33	35	29	26

The measurements were made on four different specimens and of the first seven pores (Pl. LIII. fig. 9, *a*).

In the supra- and sub-orbital groups the pores are more closely grouped. Each leads into a narrow tube which passes downwards and with its fellows OPENS INTO A SINGLE WIDE TUBE; this continues for a short distance and then terminates in a spongy mass of ampullæ (Pl. LIII. fig. 9, *b*). The whole of the spongy mass is enclosed in an ill-defined connective-tissue capsule. In the maxillo-mandibular groups the canals approach more nearly to those described and figured by Leydig, and it seems very probable that he examined only those in this region and in the region of the Y-shaped commissure.

Thus in *Chimæra* it will be seen that there are three types of ampullary canals, viz.:—(1) A simple unbranched tube which gradually becomes wider as it leaves the surface and finally expands into an ill-defined ampulla (Pl. LIII. fig. 9, *a*); (2) a series of tubes much smaller than number 1, all of which lead into a common tube, considerably wider, from which numerous ampullæ are given off (Pl. LIII. fig. 9, *b*); and (3) a simple unbranched tube, at the base of which are a series of well-defined ampullæ (Pl. LIII. fig. 9, *c*).

It is possible that ampullary canals like numbers 1 and 2 may yet be found in the Elasmobranchii: a careful investigation of the system in the Batoidei is much to be desired.

The minute structure is almost identical with that of the Elasmobranchii, the chief difference being, that in the sensory organ at the base of the ampulla, in *Chimæra*, the epithelium-cells of the "Centralplatte" form a concavity, in which rests the "cupula terminalis" of Solger (Pl. LIII. fig. 10); whereas in the Elasmobranchii these cells are arranged as a flat plate as shown in fig. 11. Solger was the first to describe this difference.

3. *Innervation.*

The ampullary canals are all innervated by branches of the trigeminal[1], the branches which innervate the sensory organs of the sensory canal-system giving off branches to the ampullæ, as shown below:—

Median group. Posterior and anterior Supra-orbital group.	Supplied by dorsal branches of the ramus ophthalmicus superficialis (V.).
Posterior and anterior Sub-orbital group.	Supplied by the ramus buccalis and maxillaris superior (V.).
Posterior and anterior Maxillo-mandibular group.	The ramus maxillaris inferior supplies these. Where there are a few scattered ampullary canals in the mandibular region, branches of the ramus mandibularis (V.) innervate them.

IV. SUMMARY AND CONCLUSION.

1. In *Chimæra* the canals and branches persist as open grooves, agreeing in this feature with the condition which obtains in the Elasmobranchii; variations, however, sometimes occur.

2. Unlike the condition found in many Elasmobranchii, in *Chimæra* there are no fine dendritic branches from either the lateral or main canal, or from any of the branches of the latter.

3. Ampullary canals are present, three distinct types being found in different regions of the head. Their number, position, and even structure is subject to much variation. *They are all innervated by branches of the trigeminal nerve.*

4. The innervation of the sensory canals &c. proceeds from

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[1] "It is worthy of note that all the groups of ampullæ—superficial ophthalmic, inner and outer buccal, hyoid and mandibular—are supplied by dorsal branches of the facial" (Ewart, 6. p. 81).

the trigeminal facial and vagus. It may conveniently be expressed as follows:—

TRIGEMINAL.	
Ramus ophthalmicus superficialis. *Ramus ophthalmicus profundus.*	Innervate the main canal of the head and the supra-orbital branch.
Ramus buccalis. *Ramus maxillaris superior.*	Innervate the sub-orbital branch and the Y-shaped commissure of the main canal of the head.
Ramus maxillaris inferior.........	Innervates the maxillary division of the maxillo-mandibular branch.
Ramus mandibularis..............	Innervates the mandibular division of the maxillo-mandibular branch.
FACIAL.	
Ramus hyoideus.....................	Innervates the jugular canal of Garman.
VAGUS.	
Ramus vagi lateralis...............	Innervates the lateral canal.

It will thus be seen *that the facial nerve is almost entirely replaced by the trigeminal*, not unlike the condition I have previously described in the Physostomous Teleostei (**5**).

5. The vagus arises distinct from the glossopharyngeal nerve, and leaves the skull by a separate foramen. The branching is not unlike that figured and described by Pinkus (**13**) in *Protopterus*.

6. There is a commissural connection between the vagus and facial (? trigeminal), probably homologous with that which obtains in *Ceratodus*, *Protopterus*, and *Lepidosiren*.

7. The combined vagi lateralis and commissure run posteriorly quite close to the vertebral column, as in *Lepidosiren*.

8. In the form of the canals and branches, and the possession of ampullary canals, the system resembles that found in the Elasmobranchii; on the other hand, in the innervation it more nearly resembles the condition found in the Teleostei and Dipnoi.

9. Hitherto most zoologists have classed the Holocephali with the Elasmobranchii; Huxley, Gegenbaur, and a few others, however, have preferred to regard them as a distinct class. The results obtained by an examination of the innervation of the sensory canal-system strengthen, I think, the grounds for this separation.

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I.

I. ELASM	EOSTEOIDEI.	IV. TELEOSTEI.
GENERAL FEATUR BR	RES OF THE CANALS AND BRANCHES.	GENERAL FEATURES OF THE CANALS AND BRANCHES.
The canals usually open groove an They are partly *Heptabranchias* *lachus, Heterodon*	by scales, and pass through d.	Canals sometimes dermal (*Amiurus*) or protected by scales or drain-pipe-like canal-bones, or represented only by sensory organs, or both absent (*Ostracions, Centriscus*). In some cases (*Coris*) the canal passes through modified scales only. In *Exocetus* the Lateral canal passes dorsal to the pelvic fin and ventral to the pectoral, the canals of either side converging ventrally. In *Conger, Solea*, &c., saccular dilatations pass off from the canals. In the deep-sea Teleosts, e. g. *Cottus bathybius, Liparis micropus, Lycodes murœna*, &c., the canals are in the form of open grooves. In some Pleuronectidæ 2 or 3 lateral canals. In *Mugil* 9 are present (*M'Donnell*).
Occipital commissu	re present, also in frontals d in ethmoid (*Polypterus*).	Occipital commissure nearly always present, sometimes one in frontal region.
Branching genera fine dendritic b the Lateral can canals and bra ventral surface, e	ng profuse in *Lepidosteus*. m the Lateral canal.	Dendritic branching occasionally present.
Cluster and primiti	tive pores usually few.	Cluster and primitive pores few, where present.
Accessory sensory canal-system.	ry organs.	Accessory sensory organs sometimes occur (*Amiurus*, &c.).
INN	NERVATION.	INNERVATION.
1. *Lateral Canal.*	X. Vagi lateralis.	1. *Lateral Canal.* X. Vagi lateralis. In the Ostracions the vagi lateralis is more or less rudimentary (*Günther*).
2. *Main Canal.* ganglion and	X. Branch from vagi Glossopharyngeal, and V. .	2. *Main Canal.* V. Ramus ophthalmicus superficialis, the ramus oticus sometimes (*Amiurus*); the glossopharyngeal may either innervate a portion or the whole. The vagus may or may not by anterior branches supply the initial portion of the main canal.
3. *Occipital Comm* ganglion.	*missure.* Branch from X. .	3. *Occipital Commissure.* Glossopharyngeal.
4. *Hyo-mandibula* hyo-mandibul	*bular branch.* VII. Ramus laris.	4. *Operculo-mandibular branch.* VII. Ramus hyo-mandibularis. In *Amiurus*, ramus oticus and ramus mandibularis (V.).
5. *Supra-orbital b* thalmicus sup	*branch.* VII. Ramus oph- erficialis.	5. *Supra-orbital branch.* V. Ramus ophthalmicus superficialis.
6. *Sub-orbital bra*	*nch.* VII. Ramus buccalis.	6. *Sub-orbital branch.* V. Ramus buccalis and ramus maxillaris.
The Glossophary does not enter i canal-system.		

V. Comparison with the Elasmobranchii, Ganoidei, and Teleostei.

I. ELASMOBRANCHII.	II. HOLOCEPHALI.	III. GANOIDEI.		IV. TELEOSTEI.
		a. Selachoidei.	b. Teleostoidei.	
General Features of the Canals and Branches.	General Features of the Canals and Branches.	General Features of the Canals and Branches.	General Features of the Canals and Branches.	General Features of the Canals and Branches.
The canals usually have the form of an open groove and are purely dermal. They are partly or wholly tubular in *Heptabranchias maculatus*, *Chlamydoselachus*, *Heterodontus philippi*, &c.	The canals persist either as open grooves (*Chimæra*) or as tubes (*Callorhynchus*); in certain regions they are protected by cartilages.	The canals in some cases are largely dermal (*Polyodon*, *Psephurus*). In all cases drain-pipe-like canal bones are present.	Canals protected by scales, and pass through bones of the head.	Canals sometimes dermal (*Amiurus*) or protected by scales or drain-pipe-like canal-bones, or represented only by sensory organs, or both absent (*Ostracions*, *Centriscus*). In some cases (*Coris*) the canal passes through modified scales only. In *Exocœtus* the Lateral canal passes dorsal to the pelvic fin and ventral to the pectoral, the canals of either side converging ventrally. In *Conger*, *Solea*, &c., saccular dilatations pass off from the canals. In the deep-sea Teleosts, e. g. *Cottus bathybius*, *Liparis micropus*, *Lycodes muræna*, &c., the canals are in the form of open grooves. In some Pleuronectidæ 2 or 3 lateral canals. In *Mugil* 9 are present [illegible].
Occipital commissure usually present.	Occipital commissure present, and one in the nasal region.	Occipital commissure present (*Acipenser*), sometimes imperfect (*Polyodon*).	Occipital commissure present, also in frontals (*Lepidosteus*) and in ethmoid (*Polypterus*).	Occipital commissure nearly always present, sometimes one in frontal region.
Branching generally profuse. Numerous fine dendritic branches given off from the Lateral canal. In some cases the canals and branches are absent on the ventral surface, e. g. *Torpedo*, *Narcine*.	No fine dendritic branching. No branches from the Lateral canal.	Slight branching. Branches from the Lateral canal.	[illegible] No branches from the Lateral canal.	Dendritic branching occasionally present.
Cluster and primitive pores numerous.	Cluster-pores few. No primitive pores.	Cluster and primitive pores in abundance.	Cluster and primitive pores usually few.	Cluster and primitive pores few, where present.
Accessory sensory organs distinct from the canal system.	No accessory sensory organs.	Accessory sensory organs present.	No accessory sensory organs.	Accessory sensory organs sometimes occur (*Amiurus*, &c.).
Innervation.	Innervation.	Innervation.	Innervation.	Innervation.
1. *Lateral Canal.* X. Vagi lateralis.	1. *Lateral Canal.* X. Vagi lateralis, which is joined by a commissure from the facial (VII.) or trigeminus (V.).	1. *Lateral Canal.* X. Vagi lateralis.	1. *Lateral Canal.* X. Vagi lateralis.	1. *Lateral Canal.* X. Vagi lateralis. In the Ostracions the vagi lateralis is more or less rudimentary (*Günther*).
2. *Main Canal.* Branches from the vagus ganglion and ramus oticus.	2. *Main Canal.* V. Ramus ophthalmicus superficialis.	2. *Main Canal.* V. Ramus oticus.	2. *Main Canal.* X. Branch from vagi lateralis, IX. Glossopharyngeal, and V. Ramus oticus.	2. *Main Canal.* V. Ramus ophthalmicus superficialis, the ramus oticus sometimes (*Amiurus*), the glossopharyngeal may either innervate a portion or the whole. The vagus may or may not by anterior branches supply the initial portion of the main canal.
Occipital Commissure. Branch from vagus ganglion.	3. *Occipital Commissure.* Not traced.	3. *Occipital Commissure.* Branch from X. Vagi lateralis.	3. *Occipital Commissure.* Branch from X. Vagi lateralis.	3. *Occipital Commissure.* Glossopharyngeal.
Hyo-mandibular branch. VII. Ramus hyo-mandibularis.	4. *Maxillo-mandibular branch.* V. Ramus maxillaris inferior and the ramus mandibularis.	4. *Hyo-mandibular branch.* VII. Ramus opercularis superficialis.	4. *Operculo-mandibular branch.* VII. Ramus hyo-mandibularis.	4. *Operculo-mandibular branch.* VII. Ramus hyo-mandibularis. In *Amiurus*, ramus oticus and ramus mandibularis (V.).
Supra-orbital branch. VII. Ramus ophthalmicus superficialis.	5. *Supra-orbital branch.* V. Ramus ophthalmicus superficialis and profundus.	5. *Supra-orbital branch.* VII. Ramus buccalis.	5. *Supra-orbital branch.* VII. Ramus ophthalmicus [illegible].	5. *Supra-orbital branch.* V. Ramus ophthalmicus superficialis.
6. *Sub-orbital branch.* VII. Ramus buccalis.	6. *Sub-orbital branch.* V. Ramus buccalis and ramus maxillaris superior.	6. *Sub-orbital branch.*	6. *Sub-orbital branch.* VII. Ramus buccalis.	6. *Sub-orbital branch.* V. Ramus buccalis and ramus maxillaris.
The Glossopharyngeal according to Ewart does not enter into the innervation of the [illegible].	The Glossopharyngeal does not enter into the innervation of the canal-system. The ramus hyoideus VII. innervates the jugular canal.	The ramus mandibularis V. innervates primitive pores in the region of the maxilla.		

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EXPLANATION OF PLATES LI.–LIII.

Reference Letters.

a.	Ampulla.
Amp.C.	Ampullary Canals.
Au.	Auditory capsule.
Co.	Commissure from 5th or 7th nerve to the ramus vagi lateralis.
Ju.	Jugular Canal.
L.C.	Lateral Canal.
M.	Mouth.
M.C.	Main Canal.
Mn.	Mandibular division of the Maxillo-mandibular branch.
Mx.	Maxillary division of the Maxillo-mandibular branch.
Mx.Mn.	Maxillo-mandibular branch.
Oc.com.	Occipital commissure.
S.or.	Sub-orbital branch of the main sensory canal.

Sp.o.	Supra-orbital branch of the main sensory canal.
II.	Optic foramen.
III.	Oculo-motor nerve.
IV.	Pathetic nerve.
V. *r.b.*	Ramus buccalis.—Trigeminal.
V. *com.*	Commissure between the facial and trigeminal nerve.
V. *com.*[1]	Commissure between the ramus ophthalmicus superficialis and the ramus buccalis.
V. *r.mn.*	Ramus mandibularis.—Trigeminal.
V. *r.mx.*	Ramus maxillaris.—Trigeminal.
V. *r.mx.i.*	Ramus maxillaris inferior.—Trigeminal.
V. *r.mx.s.*	Ramus maxillaris superior.—Trigeminal.
V. *r.o.p.*	Ramus ophthalmicus profundus.—Trigeminal.
V. *r.o.s.*	Ramus ophthalmicus superficialis.—Trigeminal.
VI.	Abducent nerve.
VII.	Facial nerve.
VII. *r.hy.*	Ramus hyoideus.—Facial.
VII. *r.mn.*	Ramus mandibularis.—Facial.
VII. *r.p.*	Ramus palatinus.—Facial.
VIII.	Auditory nerve.
IX.	Glossopharyngeal nerve.
X.	Vagus.
X. *r.br.* 3.	Branchial nerve.
X. *r.int.*	Ramus intestinalis.
X. *r.lat.s.i.*	Ramus lateralis superficialis inferior.
X. *r.mot.*	Motor branches from Vagus ganglion.
X. *r.v.lat.*	Ramus vagi lateralis.

Fig. 1. Lateral view of the head of *Chimæra*, showing the distribution of the sensory and ampullary canal-system.
2. Portion of the canal-system showing variation. The branch *x* arising from the main canal of the head.
3. Anterior view of the head of *Chimæra*, showing the connection of the supra- and sub-orbital branches, and the Y-shaped commissure connecting the same with the maxillo-mandibular branch.
4. Diagrammatic view of the dorsal surface of the head of *Chimæra*, showing the main canal and branches, and the occipital commissure.
5. Transverse section through the lateral canal. *c.* Cavity. *n.f.* Nerve-fibre.
6. Cartilaginous hoops from the sub-orbital branch of the main sensory canal.
7. Diagrammatic view of the distribution of the cranial nerves.
8. Lateral view of the posterior portion of the cranium of *Chimæra*, showing the foramina for the exit of the cranial nerves.
9. Ampullary canals from the head of *Chimæra*:—*a*, from the occipital group; *b*, from the sub-orbital group; *c*, from the maxillary group. *amp.* Ampulla. *c.* Canal. *n.f.* Nerve-fibre. *p.* Pore.
10. Sensory organ from the base of an ampullary canal in *Chimæra*.
11. The same from an ampullary canal in *Scyllium*. *cp.* Cupola. *ep.* Epithelium. *n.f.* Nerve-fibre.

3. Note in Correction of a Paper on Colour-variation in Flat-fishes. By W. Bateson, M.A., F.R.S., Fellow of St. John's College, Cambridge.

[Received December 11, 1895.]

In the 'Proceedings' of this Society, 1894, p. 246, I published an account of an abnormal Brill (*Rhombus lævis*) having a series of dark spots along the dorsal and ventral borders of the body on the "blind" side. In commenting on this case, stress was laid on the fact that the corresponding parts of the dorsal and ventral borders had thus varied similarly and simultaneously. At the time I was under the impression that the variation observed was a sudden appearance of a character not otherwise met with in Flat-fishes; but since the publication of the paper Professor W. C. McIntosh has informed me that flat-fishes of some species in the ordinary course of development, while swimming on edge, go through a stage in which they are marked on both sides with a row of dorsal and ventral spots placed just as in my specimen. He has referred me to his paper in Proc. Roy. Inst. 1889, xii. p. 396, where examples of such larval fishes are figured. I am further indebted to Prof. McIntosh for a specimen showing this condition, and similar specimens were also shown to me by Mr. E. W. L. Holt.

My case of variation is therefore an example of a persistence of larval coloration, and not of the appearance of a new character. It is consequently much less important than I imagined, though the comment respecting the similarity and simultaneity of the variation of the two borders still applies.

4. On the Orthoptera of the Sandwich Islands.

By Herr Brunner v. Wattenwyl[1].

[Received November 19, 1895.]

The Orthopterological Fauna of the Sandwich Islands is little known, so that all collections made in them ought to produce novelties. Mr. Aug. de Bormans, in 1882, published descriptions of 17 species. The collection made by Mr. R. C. L. Perkins with much labour in 1894 contains examples of 23 species, which are only in part identical with those of the first collection.

If we combine the results of these two explorations, we must confirm the conclusion already arrived at by Mr. de Bormans that this fauna is distinguished by its poverty, and notably by the absence of the *Mantodea* and *Phasmodea*. The *Acridiodea* are represented by only a single species.

With the exception of some cosmopolitan species, the fauna is composed of species already known from the Australian Archipelago and of autochthonous species that are allied to the others. The genus *Brachymetopa*, represented by three or four species, is peculiar to the Hawaiian Archipelago. It is a member of the group *Conocephalini*.

In the family *Gryllodea* the two new species of *Paratrigonidium* are remarkable. This genus, hitherto, has only been recorded from Asia.

A new genus, *Prognathogryllus*, consists of two anomalous forms.

Finally we meet with two species which evidently are recent importations. The first of these is *Oxya velox*, Fab., the unique representative of the *Acridiodea*, which is very common in the

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[1] Communicated by Dr. D. Sharp, F.Z.S., on behalf of the Committee for investigating the Fauna of the Sandwich Islands.

Malay Islands, and the second a *Xiphidium*, which I cannot distinguish from a European species.

DERMAPTERA.

1. ANISOLABIS LITTOREA, White.

Forcinella littorea, Dohrn, Stett. ent. Zeit. xxv. p. 287.

Oahu; Haleakala, Maui (*Borm.*).

2. ANISOLABIS MARITIMA, Bon.

Anisolabis maritima, Brunner, Prodr. p. 9.

Maui (*Borm.*).

3. ANISOLABIS PACIFICA, Erichs.

Koele, Lanai; Waimea, Kauai, 3000 ft. (*Perkins*).

4. ANISOLABIS ANNULIPES, Luc.

Molokai, 3000–4000 ft. (*Perkins*).

5. LABIA PYGIDIATA, Dubr.

Labia pygidiata, Dubrony, Ann. Mus. Civ. Genov. xiv. p. 364.

Oahu (*Borm.*); Kona, Hawaii (*Perkins*).

6. CHELISOCHES MORIO, Fab.

Lobophora morio, Dohrn, Stett. ent. Zeit. xxvi. p. 71.

Common in the whole archipelago (*Borm.*); Pelekunu, Molokai (*Perkins*).

7. FORFICULA HAWAIENSIS, Borm.

Forficula hawaiensis, de Bormans, Ann. Mus. Civ. Genov. xviii. p. 341.

Several islands (*Borm.*).

BLATTODEA.

8. PHYLLODROMIA HIEROGLYPHICA, Brun.

Phyllodromia hieroglyphica, Brun. Nouv. Syst. Blattaires, p. 105.

Oahu (*Perkins, Borm.*); Lanai, Kauai (*Perkins*).

9. PHYLLODROMIA OBTUSATA, sp. n.

Colore testaceo. Caput latum, testaceum unicolor. Antennæ fuscæ. Pronotum unicolor vel disco leviter fusco-delineato, latum, antice et postice truncatum. Elytra abdomen haud superantia, unicoloria. Alæ apice obtusæ, leviter infumatæ, vena ulnari simpliciter furcata. Femora antica subtus submutica, apicem versus spinulis minimis alineatis armata. Abdomen fuscum. Lamina supra-analis ♀ triangularis, apice triangulariter emarginata. Lamina subgenitalis ♀ late triangularis. ♀.

	♀.
Long. corporis	7·5–9·5 millim.
„ pronoti	2·2–2·5
Lat. pronoti	3·5–3·7
Long. elytrorum ..	5·6–7

Kona &c., Hawaii (*Perkins*).

10. STYLOPYGA DECORATA, Brun.

Stylopyga decorata, Brun. Nouv. Syst. Blattaires, p. 224.

Honolulu, in the houses (*Borm.*).

11. METHANA LIGATA, Brun.

Methana ligata, Brun. Nouv. Syst. Blattaires, p. 234.

Honolulu, in the houses (*Borm.*).

12. PERIPLANETA AMERICANA, L.

Honolulu (*Borm.*).

13. ELEUTHERODA DYTISCOIDES, Serv.

Eleutheroda dytiscoides, Brun. Nouv. Syst. Blattaires, p. 265.

Honolulu (*Perkins*); Honolulu, in the wall-trees (*Borm.*).

14. LEUCOPHÆA SURINAMENSIS, Fab.

Leucophæa surinamensis, Brun. Nouv. Syst. Blattaires, p. 278.

Environs of Honolulu, under stones (*Borm.*); Maui, Wailuku (*Perkins*).

15. ONISCOSOMA PALLIDA, Brun.

Oniscosoma pallida, Brun. Nouv. Syst. Blattaires, p. 301.

Haleakala, Maui, 650 m. (*Borm.*).

16. EUTHYRRAPHA PACIFICA, Coqueb.

Euthyrrapha pacifica, Brun. Nouv. Syst. Blattaires, p. 343.

Honolulu (*Borm.*); Kaawaloa, Hawaii (*Perkins*).

ACRIDIODEA.

17. OXYA VELOX, Fab.

Oxya velox, Brun. Rév. Syst. p. 152.

Waianae Mts., Oahu, 1600 ft., April (*Perkins*).

LOCUSTODEA.

18. ELIMÆA APPENDICULATA, Brun.

Elimœa appendiculata, Brun. Monogr. Phaneropt. p. 101.

Honolulu (*Borm.*, *Perkins*).

19. BRACHYMETOPA DISCOLOR, Redtenb.

Brachymetopa discolor, Redtenb. Verh. z.-b. Ges. Wien, 1891, p. 431.

Honolulu (*Redtenb.*); Kaala Mts., Waianae Mts., Oahu (*Perkins*).

20. BRACHYMETOPA BLACKBURNI, Borm.

Brachymetopa blackburni, Redtenb. l. c. p. 431.

In nearly all the Islands, on the forest trees (*Borm.*).

21. BRACHYMETOPA DEPLANATA, sp. n.

Viridis vel griseo-testacea. Fastigium verticis æque latum ac longum, apice rotundatum, superne deplanatum. Antennæ unicolores viridi-flavæ. Frons viridis. Labrum cum mandibulis pallide ferrugineum. Elytra variabilia, abdominis longitudine vel medium ejus haud superantia, tympano in elytro sinistro ♂ subopaco. Pedes unicolores. ♂ ♀.

	♂.	♀.
Long. corporis........	19	21 millim.
,, fastigii vert.	1·1–1·5	1·9
,, pronoti	5·5–5·6	5·9
,, elytrorum	6–9·5	9
,, femor. post.	10–11·5	12·5
,, ovipositoris	....	11·5

Lanai, 2000 ft.; Kalae, 4000 ft.; Molokai; Makaweli, 3000 ft., Kauai (*Perkins*).

22. BRACHYMETOPA NITIDA, sp. n.

Viridis vel griseo-testacea. Fastigium verticis angustius quam longius. Antennæ unicolores virides. Frons viridis. Labrum pallidum. Mandibulæ subtotæ nigræ. Elytra in ♂ abdomen æquantia, in ♀ medium ejus superantia, tympano in elytro sinistro ♂ nitido. Femora omnia in apice ipso nigro-bipunctata. ♂ ♀.

	♂.	♀.
Long. corporis......	21	22·5 millim.
,, fastigii vert. ..	1·2	1·2
,, pronoti	5·7	6·4
,, elytrorum ..	12	13
,, femor. post. ..	13	14·5
,, ovipositoris ..	..	11·5

Kona, Mauna Loa, 2000 ft., Hawaii (*Perkins*).

23. XIPHIDIUM FUSCUM, Fab.

Xiphidium fuscum, Redtenb. Verh. z.-b. Ges. Wien, 1891, p. 508.

Pauoa, Oahu, Dec. 1892 (*Perkins*).

GRYLLODEA.

24. GRYLLUS INNOTABILIS, Walk.

Gryllus innotabilis, Sauss. Mél. Orth., V. Gryllides, p. 336.

In nearly all the Islands of the Archipelago (*Borm.*); Kalae, Molokai; Waianae, Oahu; Kona, 2000 ft., Hawaii (*Perkins*).

25. GRYLLODES POEYI, Sauss.

Gryllodes poeyi, Sauss. Mél. Orth., V. Gryllides, p. 387.

Waianae Mts., Oahu; Waimea Mts., 3000 ft., Kauai (*Perkins*).

26. PARATRIGONIDIUM PACIFICUM (Scudd.).

Trigonidium pacificum, Scudd. Proc. Bost. Soc. N. H. xii. p. 139 (1868).

The description given by Scudder being very incomplete, I give a new diagnosis of this species, which comes into my genus *Paratrigonidium* (Révision du syst. des Orth. p. 208).

Colore castaneo. Frons pallide signata. Antennæ fuscæ. Pronotum pilis fuscis raris obsitum. Elytra apicem abdominis attingentia, in ♂ plana, tympano venulis indistinctis toto rugosa. Elytra in ♀ fornicata, cornea, venis parallelis rectis necnon venis spuriis intercalatis instructa. Pedes fusco et pallide variegati. Tibiæ anticæ in latere externo tympano minimo instructæ. ♂ ♀.

	♂.	♀.
Long. corporis	6	7 millim.
„ pronoti	1·6	1·5
„ elytrorum ..	4·4	4·5
„ femor. post. .	5	5·8
„ ovipositoris ..	..	3

Environs of Honolulu (*Borm.*); Waianae, Oahu; Kauai; Lanai; Molokai; Kona, Hawaii (*Perkins*).

27. PARATRIGONIDIUM ATROFERRUGINEUM, sp. n.

Colore atro et ferrugineo. Caput cum pronoto atrum. Antennæ, excepto articulo basali, cum palpis ferrugineæ. Elytra in ♂ ferruginea, plana, medio atra, in ♀ unicoloria ferruginea. Femora omnia atra, apice ferruginea. Tibiæ ferrugineæ. Ovipositor ater. ♂ ♀.

	♂.	♀.
Long. corporis	7·5	6·8 millim.
„ pronoti	1·5	1·6
„ elytrorum ..	4·6	4
„ femor. post ..	4·3	4.5
„ ovipositoris ..	..	3

Molokai, 4000 ft. (*Perkins*).

I am obliged to create a new genus for two species peculiar to the Hawaiian Archipelago. This genus belongs to the *Podoscirtes* group, and is distinguished from all the other genera of this group

by the more porrect head, so that the front forms a very obtuse angle with the vertex. This extraordinary form approaches most nearly to the genus *Stenogryllus* of Saussure.

PROGNATHOGRYLLUS, gen. nov. ex tribu Podoscirtium.

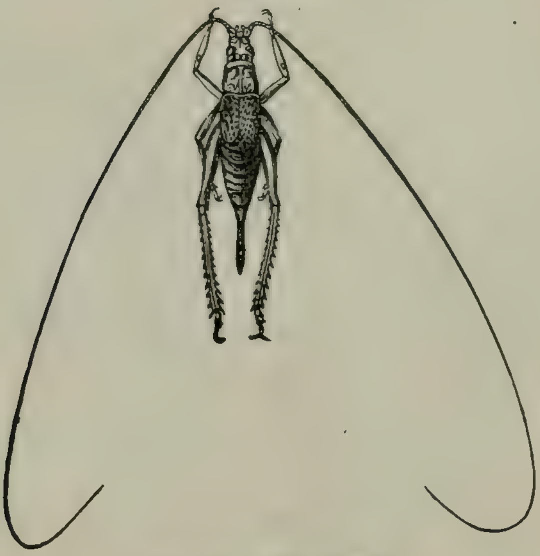
Corpus gracile. Caput prognathum. Vertex valde depressus, cum fronte angulum obtusissimum formans. Frons inter antennas compressa. Antennæ longissimæ, fortiores. Pronotum elongatum, planum, latere vix deflexum. Elytra valde abbreviata vel nulla. Alæ nullæ. Femora postica a basi sensim graciliscentia. Tibiæ anticæ muticæ, tympano nullo instructæ. Tibiæ posticæ superne utrinque serrulatæ vel in latere interno spinalis longioribus instructæ; calcaribus tribus externis brevissimis, duobus internis majoribus, superiore duplo longiore quam inferius. Tarsi postici elongati, metatarso terete, mesotarso bilobato, articulo ultimo metatarso æque longo. Ovipositor subrectus, femore postico haud longior. ♀

Dispositio specierum.

1. Elytra brevia adsunt. Tibiæ posticæ superne in latere interno spinis distinctis armatæ	1. *alatus*, sp. n.
1′. Elytra nulla. Tibiæ posticæ superne utrinque serrulatæ	2. *forficularis*, sp. n.

28. PROGNATHOGRYLLUS ALATUS, sp. n. (Fig. 1.)

Fig. 1.



Prognathogryllus alatus.

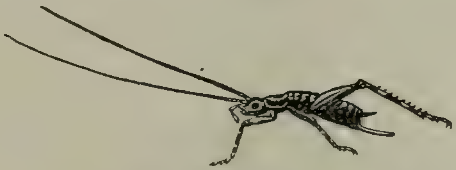
Ferrugineus. Frons infra insertionem antennarum cum marginibus scrobum antennarum infuscata. Occiput fasciis fuscis ornatum. Pronotum fusco-variegatum, margine postico late *limbato. Elytra metanotum parum superantia, fusca, venis pallidis. Tibiæ posticæ in margine interno spinulis* 10 *armatæ. Cerci ovipositorem æquantes.* ♀.

Long. corporis....	21 millim.
„ pronoti	4
„ elytrorum ..	5·5
„ femor. post.	12
„ ovipositoris .	8·5

Waimea Mts., 4000 ft., Kauai (*Perkins*).

29. Prognathogryllus forficularis, sp. n. (Fig. 2.)

Fig. 2.



Prognathogryllus forficularis.

Statura minore. Corpore aptero, fusco-ferrugineo, latere utrinque fascia fusca a capite usque ad apicem abdominis ornato. Frons cum occipite tota pallida. Antennæ graciles, infuscatæ. Pronotum margine postico truncato, acuto (non limbato). Tibiæ omnes fusco-annulatæ, posticæ superne utrinque serratæ. Cerci tertiam partem ovipositoris haud superantes. ♀.

Long. corporis....	12 millim.
„ pronoti	3
„ femor. post.	7·5
„ ovipositoris .	4·5

Kona, 3000 ft., Hawaii (*Perkins*).

5. On the Classification of the *Schœnobiinæ* and *Crambinæ*, two Subfamilies of Moths, of the Family *Pyralidæ*. By G. F. Hampson.

[Received October 7, 1895.]

The two subfamilies of Pyralidæ, the *Schœnobiinæ* and *Crambinæ*, of which a classification is here given, have much resemblance to each other in both superficial appearance and structure, and are also equally nearly related to the *Hydrocampinæ*, all three subfamilies being parallel developments from the primitive stock of the Pyralidæ, of which the more generalized *Pyraustinæ* and the *Scopariinæ* are probably the nearest living representatives.

The *Schœnobiinæ* have become differentiated from the *Pyraustinæ* in the loss of the proboscis, the *Crambinæ* in the pectination of the median nervure of the hind wing, whilst the long porrect palpi and triangularly scaled maxillary palpi are highly characteristic of nearly the whole of the genera of both subfamilies.

The classification of the *Schœnobiinæ* as a group is new; their habitat being principally in the Oriental and Neotropical regions, with but few genera and species in the Palæarctic region.

The *Crambinæ*, however, are found in almost equal numbers in all the Zoological regions, and their classification, as here given, is an extension of the excellent system adopted by Mr. Meyrick in his paper on the Pyralidæ of the European fauna.

The types of all the new species described are in the Collection of the British Museum, and I have to thank Mr. W. Schaus for the generous gift of examples of all the species, from the Neotropical region, of which he had more than one specimen in his collection, for purposes of description in this paper. I have also to thank Mr. Meyrick for the loan of many Australian and New Zealand species which were not in the collection of the British Museum, and Mr. Bethune-Baker for the loan of many Palæarctic species. I have included the well-known European species without references and synonymy, which can easily be found in Staudinger's catalogue and other works, but full references are given to extra-Palæarctic species. Species of which I have examined specimens, but which are not represented in the British Museum collection, are marked with an asterisk; species of which I have not been able to see specimens and of which the classification is uncertain are placed at the end of each genus; and described species of which the types are in the Museum are marked thus (†); whilst at the end of the paper will be found a list giving the families to which species wrongly described as *Crambinæ* should be referred.

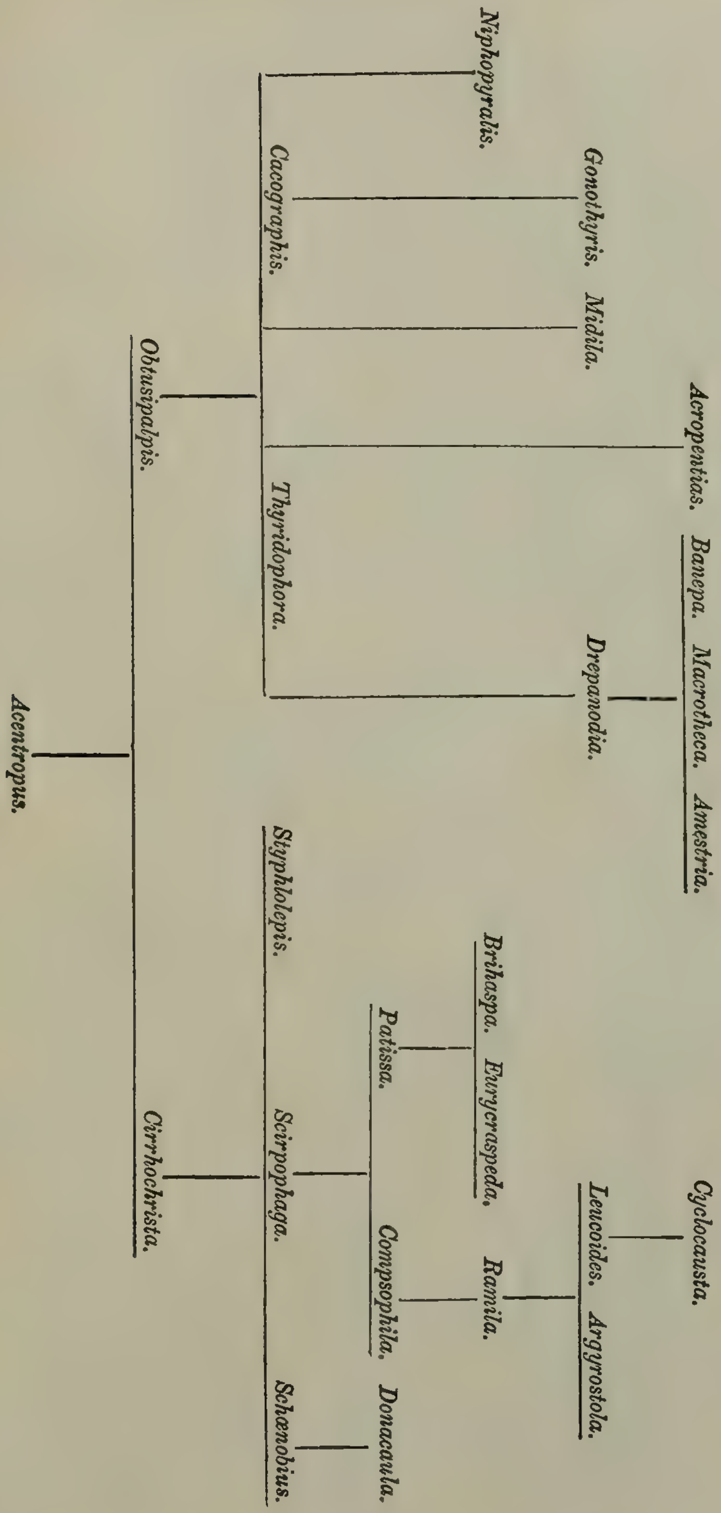
Subfamily SCHŒNOBIINÆ.

Proboscis absent or very minute; palpi usually porrect, the maxillary palpi being usually well developed and dilated with scales at extremity. Fore wing with vein 7 usually from cell. Hind wing with the median nervure not pectinated on upperside; vein 7 usually anastomosing with 8.

The larvæ of the species of which the early stages are known feed in the interior of reeds or on aquatic plants.

The absence of the proboscis, combined with the non-pectination of the median nervure of the hind wing, will distinguish the genera of this subfamily from all other Pyralidæ, except *Aglossa*, *Crocalia*, and a few other genera of the Pyralinæ, from which those forms that have vein 7 of the fore wing stalked with 8, 9 are easily distinguished by vein 7 of the hind wings anastomosing with 8.

PHYLOGENY OF THE SCHŒNOBIINÆ.



Key to the Genera.

A. Palpi upturned.
  a. Maxillary palpi minute; antennæ of male pectinated; fore wing with veins 8, 9 stalked .... 1. *Niphopyralis.*
  b. Maxillary palpi well developed; antennæ of male non-pectinate.
    a'. Fore wing with veins 8, 9, 10 stalked; the outer margin angled at vein 3 .... 2. *Gonothyris.*
    b'. Fore wing with veins 8, 9 stalked; the outer margin evenly curved .... 3. *Cacographis.*
B. Palpi with the 2nd joint porrect, the third upturned; fore wing with veins 7, 8, 9, 10 stalked .... 6. *Banepa.*
C. Palpi porrect.
  a. Fore wing with veins 7, 8, 9, 10 stalked.
    a'. Fore wing with veins 4, 5 stalked; hind wing with vein 4 absent.
      a^2. Fore wing with vein 7 from 8 before 9 .... 7. *Amestria.*
      b^2. Fore wing with vein 7 from 8 after 9 .... 8. *Macrotheca.*
    b'. Fore wing with veins 4, 5 from the cell; hind wing with vein 4 present.
      a^2. Palpi extending about four times length of head; fore wing with vein 11 free .... 9. *Drepanodia.*
      b^2. Palpi extending about twice the length of head; fore wing with vein 11 becoming coincident with 12 .... 12. *Cyclocausta.*
  b. Fore wing with vein 10 anastomosing with 7, 8, 9 to form an areole .... 13. *Argyrostola.*
  c. Fore wing with veins 7, 8, 9 stalked, 10 free.
    a'. Both wings with veins 4, 5 stalked .... 14. *Leucoides.*
    b'. Both wings with veins 4, 5 from cell.
      a^2. Fore wing with vein 11 becoming coincident with 12; the apex produced and acute .... 15. *Ramila.*
      b^2. Fore wing with vein 11 free.
        a^3. Fore wing with the apex rounded; both wings with the outer margin evenly curved. 16. *Compsophila.*
        b^3. Fore wing with the apex produced to a point; both wings with the outer margin produced to a point at vein 4 .... 4. *Midila.*
  d. Fore wing with vein 7 from cell.
    a'. Fore wing with veins 8, 9, 10, 11 stalked .... 5. *Acropentias.*
    b'. Fore wing with veins 8, 9, 10 stalked.
      a^2. Palpi projecting about twice the length of head; hind wing with vein 7 anastomosing with 8 to near apex.
        a^3. Frons smooth; abdomen with lateral tufts towards extremity.................................. 17. *Eurycraspeda.*
        b^3. Frons with a sharp tuft; abdomen without lateral tufts .... 18. *Brihaspa.*
      b^2. Palpi projecting about the length of head; hind wing with vein 7 anastomosing with 8 to about three fourths of wing .... 19. *Patissa.*
      c^2. Palpi projecting about three times length of head; hind wing with vein 7 slightly anastomosing with 8 .... 23. *Donacaula.*
    c'. Fore wing with veins 8, 9 stalked, 10 from cell.
      a^2. Fore wing with veins 6, 7 stalked.
        a^3. Palpi projecting about the length of head; fore wing of male with a hyaline vesicle beyond the cell .... 10. *Thyridophora.*
        b^3. Palpi projecting about twice the length of head and downcurved at extremity .... 20. *Styphlolepis.*

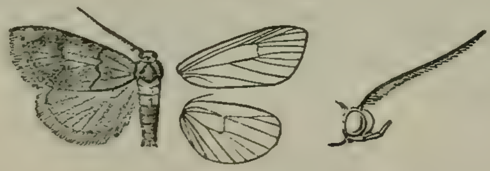
b^2. Fore wing with veins 6, 7 from cell.
  a^3. Palpi with the 3rd joint short and blunt...... 11. *Obtusipalpis.*
  b^3. Palpi with the 3rd joint long and downcurved.
    a^4. Frons flat and oblique; fore wing with the apex rounded.................................. 24. *Cirrhochrista.*
    b^4. Frons with a rounded projection; palpi once to twice the length of head........... 21. *Scirpophaga.*
    c^4. Frons with a slight tuft; palpi three to four times length of head .... 22. *Schœnobius.*
  c^3. Palpi dilated towards extremity; tibiæ with the spurs minute; fore wing with vein 1 *b* not reaching outer angle .... 25. *Acentropus.*

Genus NIPHOPYRALIS.

Niphopyralis, Hmpsn. Ill. Het. ix. p. 181 (1893).

Palpi upturned, smoothly scaled and hardly reaching vertex of head; maxillary palpi minute; frons rounded; antennæ of male bipectinated; tibiæ with the spurs nearly equal. Fore wing short and rounded; vein 3 from near angle of cell; 4, 5 from angle; 7 well separated from 8, 9; 10, 11 free. Hind wing with veins 3, 4, 5 from angle of cell; 6, 7 from upper angle.

Fig. 1.



Niphopyralis nivalis, ♂. $\frac{2}{1}$.

(1)†NIPHOPYRALIS NIVALIS, Hmpsn. Ill. Het. ix. p. 181, pl. 174. f. 6. Ceylon.

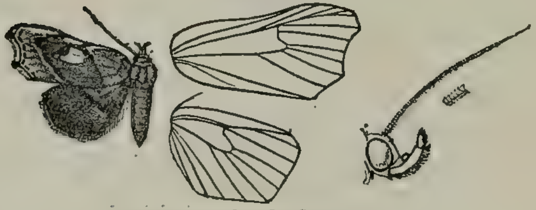
(2)†NIPHOPYRALIS CONTAMINATA, Hmpsn. Ill. Het. ix. p. 181, pl. 174. f. 14. Ceylon.

(3)†NIPHOPYRALIS ALBIDA, Hmpsn. Ill. Het. ix. p. 181, pl. 174. f. 25. Bhután; Bombay; Ceylon; Borneo.
Niphopyralis suffidalis, Swinh. A. M. N. H. (6) xvi. p. 299.

Genus GONOTHYRIS, nov.

Palpi obliquely upturned, the 2nd and 3rd joints fringed with hair in front; maxillary palpi well developed and nearly filiform; frons oblique and thickly clothed with hair; antennæ of male somewhat annulated and strongly ciliated; spurs well developed and equal. Fore wing with the costa strongly arched at base; the outer margin produced to a point at vein 7, then excised to vein 3, where it is strongly angled; vein 3 from before angle of cell; 4, 5 from angle; 7 well separated from 8, 9, 10, which are stalked. Hind wing with the outer margin angled at vein 3; 6, 7 from upper angle.

Fig. 2.



Gonothyris hyaloplaga, ♂. 1/1.

Type. †GONOTHYRIS HYALOPLAGA, n. sp.

♂. Bright vinous red; palpi slightly marked with white; vertex of head whitish; abdomen with white band on 3rd segment; underside of thorax and abdomen and the legs pure white, the fore tibia and tips of the spurs rufous. Fore wing with indistinct curved subbasal line with grey speck on it at costa; an oblique antemedial line arising from an outwardly oblique white costal fascia; a short medial white fascia on costa; a very large hyaline lunule in end of cell, with white speck beyond lower angle; a postmedial line running out to a very acute angle on vein 7, the costal area beyond it white, and the outer area grey down to vein 2; a marginal series of red spots; the cilia pale with their bases red, red also below apex and at the angle. Hind wing deeper vinous red, with oblique dark medial line. Underside white; the outer area of fore wing brownish; both wings with minutely dentate postmedial line arising from a dark spot on the costa.

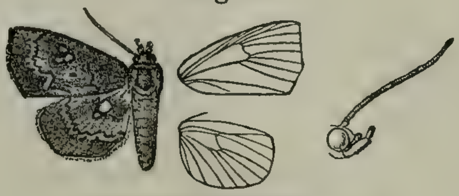
Hab. Rio Janeiro, Brazil. *Exp.* 30 mm.

Genus CACOGRAPHIS.

Cacographis, Led. Wien. ent. Mon. 1863, p. 360.
Zazanisa, Wlk. xxxiii. 1106 (1865).

Palpi obliquely upturned, the 2nd joint moderately scaled in front, the 3rd thick; maxillary palpi somewhat dilated with scales; frons oblique and heavily scaled; antennæ of male very much thickened and flattened, with appressed serrations; spurs long and nearly equal. Fore wing broad, the outer margin nearly evenly curved; vein 3 from before angle of cell; 4, 5 from angle; 7 well separated from 8, 9, which are on a very long stalk; 10, 11 free. Hind wing with veins 3, 4, 5 from near angle of cell; 6, 7 from upper angle.

Fig. 3.



Cacographis osteolalis, ♂. 1/1.

Type. CACOGRAPHIS OSTEOLALIS, Led. Wien. ent. Mon. 1863, p. 360.
Bogotá; Venezuela.

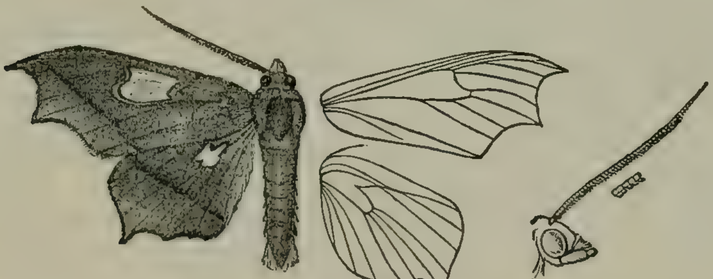
†*Zazanisa specularis*, Wlk. xxxiii. 1107.

Genus Midila.

Midila, Wlk. xvi. 8 (1858).
Ametres, H.-S. Aussereur. Schmett. p. 74 (1843), preocc.
Singamia, Moesch. Faun. Surinam, p. 433 (1881).
Tetraphana, Rag. Ann. Soc. Ent. Fr. 1890, p. 471.

Proboscis aborted; palpi thickly scaled and extending slightly beyond the frons, which is slightly prominent; maxillary palpi triangularly scaled and as long as the labial; antennæ of male with short uniseriate branches; tibiæ fringed with long hair. Fore wing with the costa arched at apex, which is much produced and acute; the outer margin produced to a long point at vein 4; vein 3 from before angle of cell; 4, 5 widely separate at origin; the discocellulars much curved; vein 6 from below upper angle; 7, 8, 9 stalked; 10, 11 free. Hind wing with the outer margin produced to a long point at vein 4; veins 2 and 3 arising close together; 4, 5 widely separated; the discocellulars strongly angled; veins 6, 7 from upper angle.

Fig. 4.



Midila quadrifenestrata, ♂. ½.

Type. Midila quadrifenestrata, H.-S. Auss. Schmett. p. 74, pl. 70. f. 401. S. America.
† „ *attacalis*, Wlk. xvi. 8.

List of undetermined Species.

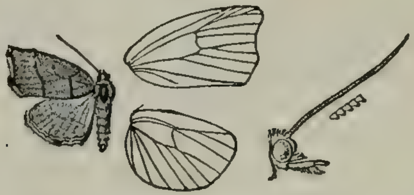
Tetraphana daphne, Druce, Biol. Centr.-Amer., Het. ii. p. 197, pl. 60. ff. 5, 6. Mexico.
Tetraphana alipes, Pagenst. Isis, v. p. 3, pl. 1. f. 1. Mexico; Amazons.

Genus Acropentias.

Acropentias, Meyr. Trans. Ent. Soc. 1890, p. 470.

Palpi porrect, extending about twice the length of head, the 2nd joint fringed with hair below and with a long pointed tuft at extremity; maxillary palpi triangularly scaled; frons rounded; antennæ of male minutely serrate and fasciculate; hind tibiæ fringed with hair on outer side. Fore wing with the outer margin somewhat excised from apex to vein 3; vein 3 from well before angle of cell; 4, 5 shortly stalked; 7 from upper angle; 8, 9, 10, 11 stalked. Hind wing with vein 3 from close to angle of cell; 4, 5 shortly stalked; 6, 7 from upper angle.

Fig. 5.



Acropentias aureus, ♂. 1/1.

Type. †ACROPENTIAS AUREUS, Butl. A. M. N. H. 1878, i. p. 402. E. Siberia; Japan.

†*Marimatha straminea*, Butl. Ill. Het. iii. p. 79, pl. 58. f. 2.

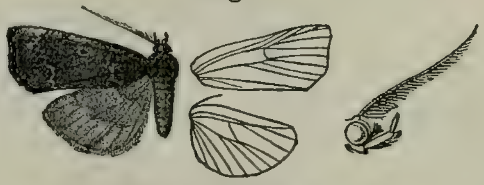
Sparagmia obtusalis, Christ. Bull. Mosc. lvi. 1881, p. 26.

Genus BANEPA.

Banepa, Moore, Lep. Atk. p. 204 (1887).

Palpi with the 2nd joint long, porrect, and clothed with hair, the 3rd upturned and long; maxillary palpi triangularly scaled; proboscis minute; antennæ of male bipectinate; legs smoothly scaled, the spurs long. Fore wing with the costa arched at base, then straight; the apex produced; the outer margin excised from apex to vein 5, where it is excurved, then oblique to outer angle; vein 3 from before angle of cell; 4, 5 from angle; 7, 8, 9, 10 stalked. Hind wing with vein 3 from before angle of cell; 4, 5 from angle; 6, 7 on a long stalk.

Fig. 6.



Banepa atkinsoni, ♂. 1/1.

Type. †BANEPA ATKINSONI, Moore, Lep. Atk. p. 204. Sikhim.

Genus AMESTRIA.

Amestria, Rag. Ann. Soc. Ent. Fr. 1890, p. 545.

Palpi porrect, thickly scaled, and reaching just beyond frons, which is rounded; maxillary palpi thickly scaled; antennæ of male ciliated; tibiæ smooth. Fore wing rather narrow; vein 3 from angle of cell; 4, 5 stalked; 6 from well below upper angle; 7, 8, 9, 10 stalked, 7 being given off before 9; 11 free. Hind wing with veins 3 and 5 from angle of cell; 4 absent; 6, 7 from upper angle.

Type. *AMESTRIA OCULIFERALIS, Rag. Ann. Soc. Ent. Fr. 1890, p. 546, pl. 5. f. 10. U.S.A.

Genus Macrotheca.

Macrotheca, Rag. Ann. Soc. Ent. Fr. 1890, p. 545.

Palpi porrect, thickly scaled, and extending about the length of head; maxillary palpi well developed and tufted with hair; frons with a slight tuft; antennæ of male ciliated; tibiæ smoothly scaled. Fore wing rather long and narrow; vein 3 from angle of cell; 4, 5 stalked; 6 from well below upper angle; 7, 8, 9, 10 stalked, 7 being given off after 9; 11 free. Hind wing with veins 3 and 5 from angle of cell, 4 absent; 6, 7 from upper angle.

Type. *Macrotheca interalbicalis, Rag. Ann. Soc. Ent. Fr. 1890, p. 545, pl. 5. f. 12. Mexico.

Genus Drepanodia.

Drepanodia, Rag. Ann. Soc. Ent. Fr. 1891, p. 616.

Palpi porrect, extending about four times length of head, almost straight and thickly scaled; maxillary palpi triangularly scaled; proboscis minute; frons produced to a conical point; antennæ of male almost simple. Fore wing with the costa arched at base, then almost straight, the apex falcate; the outer margin excised below apex and towards anal angle, excurved at middle; vein 3 from before angle of cell; 4, 5 well separated at origin; 6 from below upper angle; 7, 8, 9, 10 stalked; 11 free. Hind wing with the anal angle truncate; vein 3 from before angle of cell; 4, 5 from angle; 6, 7 shortly stalked.

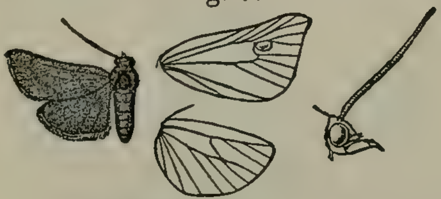
Type. *Drepanodia xerophyllalis, Rag. Ann. Soc. Ent. Fr. 1891, p. 617. Brazil.

Genus Thyridophora.

Thyridophora, Warr. P. Z. S. 1888, p. 311.

Palpi porrect and smoothly scaled, extending about the length of head, the 3rd joint downcurved; maxillary palpi long and somewhat dilated at extremity; frons flat and oblique; antennæ thickened and flattened; legs short, the tibiæ hairy, with the spurs nearly equal. Fore wing with the apex produced and the outer margin oblique; the cell very long; vein 3 from before angle; 4, 5 well separated at origin; male with a hyaline vesicle beyond upper angle below veins 6, 7, which are stalked. Hind wing with the cell very long; vein 3 from near angle; 4, 5 from angle; 6, 7 shortly stalked.

Fig. 7.



Thyridophora furia, ♂. $\frac{2}{1}$.

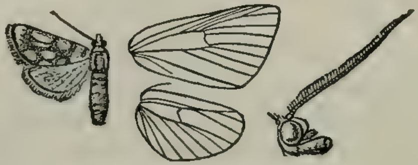
Type. †Thyridophora furia, Swinh. P. Z. S. 1884, p. 519, pl. 47. f. 13. Punjab; Sind.

† „ *fenestrata*, Warr. P. Z. S. 1888, p. 311.

Genus OBTUSIPALPIS, nov.

Palpi porrect, extending about the length of head, the 2nd joint thickly scaled and rounded at extremity, the 3rd short and blunt; maxillary palpi long and dilated with scales; frons rounded; antennæ of male ciliated; hind tibiæ with the outer medial spur minute. Fore wing with the apex rounded; veins 3, 4, 5 from close to angle of cell; 10 approximated to 8, 9; 11 free. Hind wing with vein 3 from angle of cell; 4, 5 approximated for a short distance; 6, 7 from upper angle.

Fig. 8.



Obtusipalpis pardalis, ♂. $\frac{1}{1}$.

Type. †OBTUSIPALPIS PARDALIS, n. sp.

♂. Head, thorax, and abdomen white, marked with golden brown; palpi with a black stripe above; fore legs banded with black. Fore wing golden brown, with a white basal mark; an ill-defined antemedial white band; a large medial white spot on costa, and smaller spot on inner margin; a postmedial series of three large spots; the apical area white; a spot above outer angle; a dark marginal line expanding into a series of specks at the veins. Hind wing white, with fine dark marginal line.

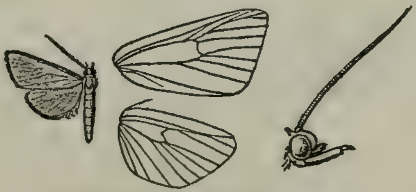
Hab. Delagoa Bay, Australia. *Exp.* 20 mm.

Genus CYCLOCAUSTA.

Cyclocausta, Warr. Trans. Ent. Soc. 1889, p. 274.

Palpi porrect, extending about twice the length of head, and moderately fringed with hair; maxillary palpi long and dilated with scales; frons rounded; antennæ of male thickened by appressed serrations. Fore wing with the apex acute and the outer margin oblique; vein 3 from before angle of cell; 4, 5 from angle; 7, 8, 9, 10 stalked; 11 becoming coincident with 12. Hind wing with vein 3 from before angle of cell; 4, 5 from angle; 6, 7 stalked; the outer margin somewhat angled at vein 2.

Fig. 9.



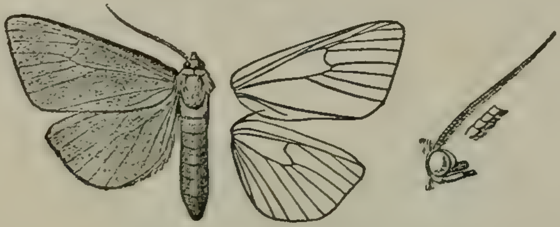
Cyclocausta trilineata, ♂. $\frac{1}{1}$.

Type. †CYCLOCAUSTA TRILINEATA, Warr. Trans. Ent. Soc. 1889, p. 274. Amazons.

Genus ARGYROSTOLA, nov.

Palpi porrect, extending about the length of head, the 3rd joint hairy; maxillary palpi with a tuft of long hair at extremity, and nearly as long as the labial; frons rounded; antennæ minutely serrate and fasciculate; spurs short. Fore wing with the apex rectangular; vein 3 from before angle of cell; 4, 5 from angle; 7, 8, 9 stalked, and 10 anastomosing with them to form an areole; 11 becoming coincident with 12. Hind wing with veins 3, 4, 5 well separated at origin; 6, 7 shortly stalked; the outer margin somewhat angled at vein 2.

Fig. 10.



Argyrostola ruficostalis, ♂. ½.

Type. †ARGYROSTOLA RUFICOSTALIS, n. sp.

♂. Silvery white; palpi, frons, fore tibiæ, and tarsi rufous; a rufous stripe on shoulders. Fore wing with the costa rufous; both wings with a more or less prominent submarginal curved series of specks.

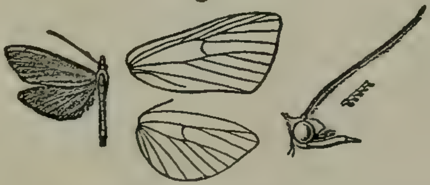
Hab. Rio Janeiro, Brazil. *Exp.* 32–44 mm.

Genus LEUCOIDES.

Leucoides, Hmpsn. Ill. Het. ix. p. 167 (1893).

Palpi porrect, slightly scaled, and extending about twice the length of head; maxillary palpi long and somewhat dilated with scales at extremity; frons produced and acute; antennæ of male minutely serrate and ciliated; legs long and slender, the outer spurs about two thirds length of inner; abdomen long; wings long and narrow. Fore wing with the apex produced and acute; the outer margin oblique; vein 3 from angle of cell; 4, 5 stalked; 6 from upper angle; 7, 8, 9 stalked; 10 free; 11 becoming coincident with 12. Hind wing with vein 3 from near angle of cell; 4, 5 stalked; 6, 7 stalked.

Fig. 11.



Leucoides fuscicostalis, ♂. ½.

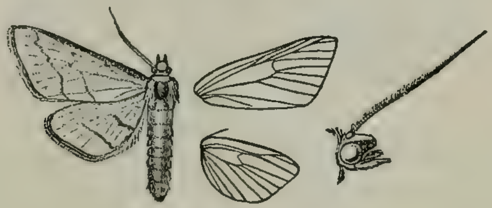
Type. †LEUCOIDES FUSCICOSTALIS, Hmpsn. Ill. Het. ix. p. 168, pl. 172. f. 18. Ceylon.

Genus RAMILA.

Ramila, Moore, P. Z. S. 1867, p. 667.
Crambostenia, Swinh. Trans. Ent. Soc. 1890, p. 292.

Palpi porrect and slightly scaled, the 3rd joint downcurved; maxillary palpi dilated with scales and nearly as long as the labial; frons produced to a rounded projection nearly as long as palpi; antennæ ciliated; tibiæ slightly hairy, the spurs short. Fore wing with the apex produced to a point; vein 3 from before angle of cell; 4, 5 from angle; 6 from near upper angle; 7, 8, 9 stalked; 11 becoming coincident with 12. Hind wing with vein 3 from before angle of cell; 4, 5 from angle; 6, 7 stalked.

Fig. 12.



Ramila marginella, ♂. $\frac{1}{1}$.

Type. (1)†**RAMILA MARGINELLA**, Moore, P. Z. S. 1867, p. 667, pl. 33. f. 16. Sikhim.

(2)†**RAMILA RUFICOSTALIS**, Hmpsn. Ill. Het. ix. p. 166, pl. 173. f. 22. Ceylon.

(3)†**RAMILA ARCUSALIS**, Wlk. xviii. 534. Moreton Bay, Australia.

(4)†**RAMILA ANGUSTIFIMBRIALIS**, Swinh. Trans. Ent. Soc. 1890, p. 293. Burma.
† ,, ,, Warr. A.M.N.H. (6) ix. p. 430.

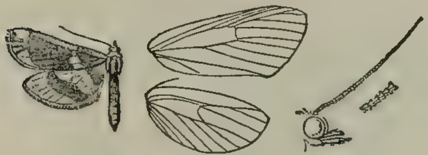
(5)†**RAMILA ACCIUSALIS**, Wlk. xix. 977; Moore, Lep. Ceyl. iii. pl. 184. f. 5. Sikhim; Ceylon; Borneo.

Genus COMPSOPHILA.

Compsophila, Meyr. Trans. Ent. Soc. 1886, p. 256.
Niphadaza, Butl. Trans. Ent. Soc. 1886, p. 422.

Palpi porrect, extending about twice the length of head, and clothed with rough hair; maxillary palpi long, with tufts of hair at extremity; frons rounded; antennæ of male annulated and ciliated; the outer spurs two thirds length of inner. Fore wing with the apex rounded; vein 3 from before angle of cell; 4, 5 from angle; 7, 8, 9 stalked; 10, 11 free. Hind wing with vein 3 from near angle of cell; 4, 5 from angle; 6, 7 from upper angle.

Fig. 13.



Compsophila iocosma, ♂. 1/1.

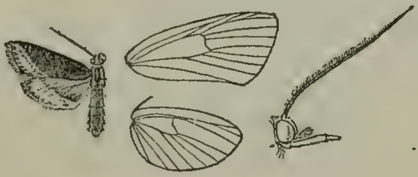
Type. COMPSOPHILA IOCOSMA, Meyr. Trans. Ent. Soc. 1886, p. 256. Fiji.
†*Niphadaza bicolor*, Butl. Trans. Ent. Soc. 1886, p. 423.

Genus EURYCRASPEDA.

Eurycraspeda, Swinh. Trans. Ent. Soc. 1890, p. 284.

Palpi porrect, slightly scaled, and projecting about twice the length of head; maxillary palpi long and dilated with scales at extremity; antennæ ciliated; abdomen long, with lateral tufts of hair towards extremity; wings long and narrow. Fore wing with vein 3 from before angle of cell; 4, 5 well separated at origin; 7 straight, and well separated from 8, 9, 10; 11 becoming coincident with 12. Hind wing with vein 3 from before angle of cell; 4, 5 well separated at origin; 6, 7 stalked.

Fig. 14.



Eurycraspeda burmanalis, ♂. 1/1.

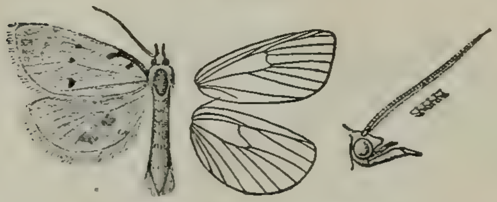
Type. †EURYCRASPEDA BURMANALIS, Swinh. Trans. Ent. Soc. 1890, p. 285, pl. 7. f. 19. Burma.

Genus BRIHASPA.

Brihaspa, Moore, P. Z. S. 1867, p. 666.
Leptosteges, Warr. Trans. Ent. Soc. 1889, p. 291.

Palpi porrect, clothed with rough hair and extending about twice the length of head; maxillary palpi long and dilated with scales at extremity; frons with a sharp tuft; antennæ of male minutely serrate and ciliated; tibiæ with the outer spurs about two thirds length of inner. Fore wing rather broad, the apex rounded, vein 3 from before angle of cell; 4, 5 well separated at origin; 7 straight and well separated from 8, 9, 10, which are stalked. Hind wing with vein 3 from before angle of cell; 4, 5 well separated at origin; 6, 7 on a long stalk, 7 anastomosing with 8 almost to apex.

Fig. 15.



Brihaspa atrostigmella, ♂. 1/1.

Sect. I. (*Brihaspa*). Fore wing with vein 11 becoming coincident with 12.

Type. (1)†Brihaspa atrostigmella, Moore, P. Z. S. 1867, p. 666, pl. 33. f. 13. Sikhim; Burma.

(2)†Brihaspa bisangulata, n. sp.

White; fore wing with indistinct interrupted fulvous subbasal band, an oblique fulvous band from costa to discocellulars, where it is met by a V-shaped fulvous mark on outer part of costa, its apex on vein 5, also by a band running from apex to vein 3, then recurved to discocellulars; a large fuscous patch between lower angle of cell and inner margin. Hind wing with the discal area from before middle to near outer margin occupied by a fuscous patch, becoming fulvous on subapical area.

Hab. Sikhim, Bengal (*Dudgeon*). *Exp.* 18 mm.

(3)†Brihaspa frontalis, Wlk. xxxiv. 1361. Natal.

Sect. II. (*Leptosteges*). Fore wing with vein 11 anastomosing with 12.

(4)†Brihaspa pulverulenta, Warr. Trans. Ent. Soc. 1889, p. 291. Amazons.

(5)†Brihaspa nigricostella, n. sp.

♂. White; palpi and a stripe on shoulders black. Fore wing with the costal area black to two thirds of wing; a black spot below middle of cell; the disk irrorated with fuscous; an oblique maculate submarginal line from below apex ending in a spot on vein 1.

Hab. Castro Paraña, Brazil (*Jones*). *Exp.* 26 mm.

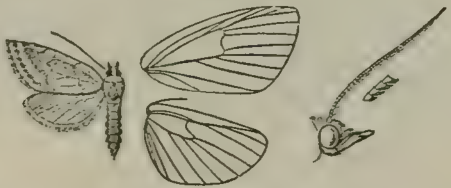
Genus Patissa.

Patissa, Moore, Lep. Ceyl. iii. p. 388 (1886).

Palpi porrect, clothed with rough hair and extending about the length of head; maxillary palpi dilated with scales; frons with a slight tuft; antennæ of male minutely serrate and ciliated; legs long and slender. Fore wing with the apex somewhat produced and the outer margin oblique; vein 3 from before angle of cell; 4, 5 well separated at origin; 7 straight and well separated from 8, 9, 10, which are stalked; 11 becoming coincident with 12.

Hind wing with vein 3 from before angle of cell; 4, 5 well separated at origin; 6, 7 stalked.

Fig. 16.



Patissa lactealis, ♂. $\frac{1}{1}$.

(1)†PATISSA LATIFUSCALIS, n. sp.

♀. White; the palpi and pectus fuscous black. Fore wing with the costal area fuscous black; a basal black patch not reaching inner margin; a medial black band very wide on costa and extending nearly to apex, narrowing to inner margin; a series of black spots on the cilia. Hind wing with diffused fuscous postmedial line, developed into a patch on middle of inner margin.
Hab. Sibsaghar, Assam. *Exp.* 26 mm.

Type. (2) PATISSA LACTEALIS, Feld. Reis. Nov. pl. 137. f. 38.
S. India; Ceylon.

(3)†PATISSA FULVOSPARSA, Butl. Trans. Ent. Soc. 1881, p. 591. Japan;
†*Metasia candidulalis*, Swinh. P. Z. S. 1885, p. 880, pl. 57. f. 6. N.W. Himalayas; W. & S. India;
Donacaula chlorosema, Meyr. Trans. Ent. Soc. 1894, p. 11. Ceylon; Burma; Java.
Patissa tortualis, Snell. Tijd. Ent. xxxvi. p. 58, pl. iii. f. 3.

(4) PATISSA XANTHOLEUCALIS, Guen. Delt. & Pyr. p. 25.
U.S.A.; Brazil.
„ *semicostalis*, Snell. Tijd. v. Ent. xxxvi. p. 60.

(5)†PATISSA ERYTHROZONALIS, n. sp.

Pure white; palpi and fore legs slightly tinged with fulvous. Fore wing with slightly oblique ferruginous band from upper angle of cell to inner margin; three ferruginous specks below costa towards apex and a marginal series of specks.
Hab. Punjab; Nilgiris; Ceylon. *Exp.* 14 mm.

(6)†PATISSA VIRGINEA, Zell. Mon. Chil. & Cramb. p. 2. W. & S.
Crambus multivagellus, Swinh. P. Z. S. 1886, p. 462. India;
Ceylon; S. Africa.

(7)†PATISSA FUSCIPUNCTALIS, n. sp.

♂. Pure shining white; palpi, antennæ at sides, and costa of fore wing dusky fulvous, the last with a dusky spot at lower angle of cell.
Hab. Espiritu Santo, Brazil. *Exp.* 24 mm.

(8)†PATISSA CURVILINEALIS, n. sp.

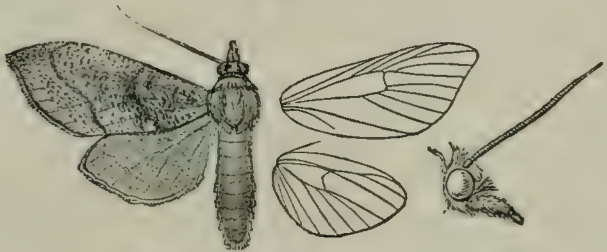
Yellowish white; palpi and antennæ tinged with rufous. Fore wing with the basal two thirds of costa reddish brown; a curved brown line from costa near apex to near base of inner margin; a marginal brown line. Hind wing white, with faint traces of an oblique medial brown line and a fine marginal line.

Hab. Ceylon (*Pole*). *Exp.* ♂ 12, ♀ 18 mm.

Genus STYPHLOLEPIS, nov.

Palpi rostriform, extending about twice the length of head, downcurved at extremity, and thickly scaled; maxillary palpi triangularly scaled; frons with a ridge of hair; antennæ of female thickened and flattened; tibiæ hairy. Fore wing with the costa arched towards apex, which is acute; veins 3, 4, 5 from close to angle of cell; 6, 7 shortly stalked; 10, 11 free. Hind wing with the outer margin produced to a point at vein 7; vein 3 from angle of cell; 4, 5 approximated for a short distance; 6, 7 from upper angle.

Fig. 17.



Styphlolepis squamosalis, ♂. $\frac{1}{1}$.

Type. †STYPHLOLEPIS SQUAMOSALIS, n. sp.

♀. White, the palpi bright ferruginous red; head and thorax suffused with ferruginous. Fore wing thickly irrorated with raised ferruginous scales; an ill-defined obliquely curved ferruginous medial line; a postmedial line angled below costa, then sinuous and inwardly oblique; a marginal line. Hind wing with hardly any ferruginous tinge; traces of a dentate submarginal line, which is well marked on underside towards costa; a slight marginal line.

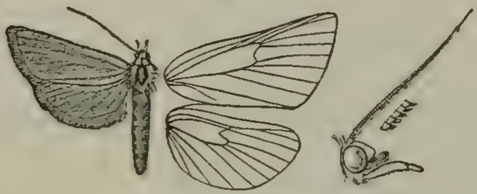
Hab. Queensland. *Exp.* 50 mm.

Genus SCIRPOPHAGA.

Scirpophaga, Treits. Schmett. Eur. ix. 1, p. 55 (1832).
Apurima, Wlk. xxvii. 194 (1863).
Rupela, Wlk. xxviii. 523.
Tipanæa, Wlk. xxviii. 522.

Palpi porrect, extending from once to twice the length of head, slightly clothed with hair and with the 3rd joint downcurved; maxillary palpi rather short and dilated with scales; a slight rounded frontal projection; antennæ of male minutely serrate and ciliated; patagia of male with spreading upturned hair; tibiæ with the outer spurs about half the length of inner; abdomen long, in female expanding at extremity and with very large anal tuft; wings long and narrow. Fore wing with vein 3 from before angle of cell; 4, 5 from angle; 7 straight and well separated from 8, 9; 10 and 11 free, or 11 becoming coincident with 12. Hind wing with vein 3 from near angle of cell; 6, 7 from upper angle.

Fig. 18.



Scirpophaga excerptalis, ♂. 1/1.

SECT. I. Hind wings with veins 4, 5 well separated at origin.

Type. (1) SCIRPOPHAGA PRÆLATA, Scop. Europe.

(2)†SCIRPOPHAGA PATULELLA, Wlk. xxviii. 522. Australia; Tasmania.
,, *exsanguis*, Meyr. P. L. Soc. N.S.W. 1882, p. 161.

(3)†SCIRPOPHAGA EXCERPTALIS, Wlk. xxvii. 142. China; Formosa; N.W. Himalayas.

(4)†SCIRPOPHAGA GILVIBERBIS, Zell. Mon. Chil. & Cramb. p. 2.
Calcutta; S. India; Ceylon; Burma.
† ,, *fusciflua*, Hmpsn. Ill. Het. ix. p. 167, pl. 172. ff. 29, 30.

(5)†SCIRPOPHAGA CHRYSORRHOA, Zell. Mon. Chil. & Cramb. p. 1.
China; Borneo; Java; Ceram.
†*Tipanæa innotata*, Wlk. xxviii. 523.

(6)†SCIRPOPHAGA OCCIDENTELLA, Wlk. xxviii. 524. Sierra Leone.

(7)†SCIRPOPHAGA AURIFLUA, Zell. Mon. Chil. & Cramb. p. 2.
Congo and Oriental region.
†*Apurima xanthogastrella*, Wlk. xxvii. 194; Moore, Lep. Ceyl. iii. pl. 184. f. 14.
Scirpophaga intacta, Snell. Tijd. Ent. xxxiv. p. 343, pl. xviii. f. 14 (var.).

(8) SCIRPOPHAGA MONOSTIGMA, Zell. Mon. Chil. & Cramb. p. 3.
Punjab; Bhután.

(9)†SCIRPOPHAGA XANTHOPERAS, n. sp.

♀. Pure white. Fore wing with black spot at upper angle of cell; the apex orange-yellow on upper and under sides.

Hab. Sumatra. *Exp.* 30 mm.

(10)†SCIRPOPHAGA INTACTELLA, Wlk. xxviii. 523. Borneo.

(11) SCIRPOPHAGA ALBINELLA, Cram. pl. 372. f. D. U.S.A.;
†*Rupela nivea*, Wlk. xxviii. 524. S. America.

(12)†SCIRPOPHAGA LEUCATEA, Zell. Mon. Chil. & Cramb. p. 2.
S. America.

(13)†SCIRPOPHAGA TINCTELLA, Wlk. xxviii. 526. Honduras.

(14)†SCIRPOPHAGA VESTALIELLA, Zell. Verh. z.-b. Wien, xxii. p. 532.
U.S.A.

(15)†SCIRPOPHAGA BISIGNATA, Swinh. P. Z. S. 1885, p. 878.
Bombay; Bengal.

(16) SCIRPOPHAGA IMPARELLA, Meyr. P. L. Soc. N. S. W. 1879, p. 176. Australia.

(17)†SCIRPOPHAGA TERRELLA, n. sp.

♀. Dull yellowish brown; abdomen with the two basal segments pale fulvous above; wings evenly irrorated with fuscous and without trace of markings.

Hab. Castro Paraña, Brazil (*Jones*). *Exp.* 34 mm.

(18)†SCIRPOPHAGA SUBCERVINELLA, Wlk. xxvii. 140. Colombia.

(19)†SCIRPOPHAGA REPUGNATALIS, Wlk. xxvii. 144.

Hab. Ignotus.

(20) SCIRPOPHAGA PERSTRIALIS, Hübn. Exot. Schmett. ff. 457, 458.
U.S.A.; S. Domingo.
†*Crambus semiradiellus*, Wlk. xxvii. 161.
Schœnobius macrinellus, Zell. Hor. Ent. Ross. xiii. p. 12, pl. 1. f. 12.

(21) SCIRPOPHAGA BIVITTA, Möschl. Verh. z.-b. Wien, xxxi. p. 437, pl. 18. f. 45. Surinam; Brazil.

SECT. II. Hind wing with veins 4, 5 closely approximated for some distance or stalked.

(22)†SCIRPOPHAGA CRAMBOIDES, Wlk. xxxi. 230. N.W. Himalayas.

List of undetermined Species.

Scirpophaga sericea, Snell. Midd. Sum. iv. (1) 8, p. 79. Sumatra.
„ *zelleri*, Möschl. Verh. z.-b. Wien, xxxi. p. 435.
Surinam.
„ *ochroleuca*, Meyr. P. L. Soc. N. S. W. iv. p. 162.
Australia.
„ *fasciella*, Fern. Ent. Am. iii. p. 38. Florida.
„ *flavicostella*, Fern. Ent. Am. iii. p. 38. Florida.
„ *butyrota*, Meyr. Tr. Ent. Soc. 1889, p. 520.
New Guinea.

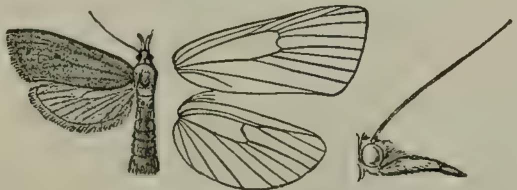
Scirpophaga longicornis, Möschl. Abh. Senck. Ges. xvi. p. 321. Porto Rico.
" *cinerea*, Treit. Europe.
" *mnesidora*, Meyr. Trans. Ent. Soc. 1894, p. 475. Sambawa.

Genus SCHŒNOBIUS.

Schœnobius, Dup. Cat. Lep. Eur. p. 312 (1844).
Catagela, Wlk. Cat. xxvii. p. 191 (1863).
Panalipa, Moore, Lep. Ceyl. iii. p. 587 (1886).
Microschœnis, Meyr. Trans. Ent. Soc. 1887, p. 270.

Palpi roughly scaled, the 2nd joint two to three times, the 3rd about the length of head; maxillary palpi dilated with scales; frons with a slight tuft; antennæ of male minutely serrate and ciliated; legs long, tibiæ with the outer spurs about two thirds length of inner; abdomen long, in female dilated at extremity and with a large anal tuft; wings long and narrow. Fore wing with the apex rounded in male, more produced in female; vein 3 from before angle of cell; 4, 5 from angle; 7 straight and well separated from 8, 9; 10, 11 free, or 11 becoming coincident with 12. Hind wing with vein 3 from before angle of cell; 4, 5 from angle; 6, 7 shortly stalked, 7 anastomosing slightly with 8, or free.

Fig. 19.



Schœnobius bipunctiferus, ♀. $\frac{1}{1}$.

SECT. I. (*Panalipa*). Palpi with the 2nd joint about twice the length of head.

(1)†SCHŒNOBIUS IMMERITALIS, Wlk. xix. 830. India; Ceylon;
†*Araxes decursella*, Wlk. xxvii. 194. Siam.

SECT. II. (*Schœnobius*). Palpi with the 2nd joint about three times length of head.

(2) SCHŒNOBIUS BIPUNCTIFERUS, Wlk. xxviii. 523. Oriental
†*Chilo gratiosellus*, Wlk. xxx. 967. region.
†*Schœnobius punctellus*, Zell. Mon. Chil. & Cramb. p. 4.
†*Apurima gratiosella*, Butl. P. Z. S. 1880, p. 690.

(3)†SCHŒNOBIUS DODATELLUS, Wlk. xxx. 966. Japan; India;
†*Chilo aditellus*, Wlk. xxx. 967. Ceylon and Burma.

Type. (4) SCHŒNOBIUS GIGANTELLUS, Schiff. Europe; Shanghai.
†*Chilo spurcatellus*, Wlk. xxvii. 142.

(5) SCHŒNOBIUS FORFICELLUS, Thunb. Europe.

(6)*SCHŒNOBIUS NILOTICUS, Zell. Stett. ent. Zeit. 1887, p. 397, and Trans. Ent. Soc. 1867, pl. 24. f. 2. Egypt.

(7)†SCHŒNOBIUS AURISTRIGELLUS, n. sp.

♂. White; palpi and shoulders golden yellow; abdomen slightly ringed with fuscous and with a dorsal yellow patch on 1st segment. Fore wing with golden-yellow fasciæ in the interspaces; a black spot at lower angle of cell; an oblique yellow line from apex to middle of inner margin. Hind wing pure white.

Hab. Bhután, Bengal (*Dudgeon*). *Exp.* 24 mm.

(8) SCHŒNOBIUS ALPHERAKII, Staud. Stett. ent. Zeit. 1874, p. 97.
Armenia.

(9)†SCHŒNOBIUS INCERTULAS, Wlk. xxvii. 143.
†*Catagela admotella*, Wlk. xxvii. 192. Oriental region.
†*Schœnobius minutellus*, Zell. Mon. Chil. & Cramb. p. 6.

(10)†SCHŒNOBIUS ADJURELLUS, Wlk. xxvii. 191. Assam; Calcutta;
† „ *brunnescens*, Moore, Lep. Atk. p. 225. Ceylon; Borneo; N. Australia.
„ *celidias*, Meyr. Trans. Ent. Soc. 1894, p. 475.

(11) SCHŒNOBIUS UNIPUNCTELLUS, Rob. Ann. Lyc. N. York, ix. 314.
U.S.A.

(12)†SCHŒNOBIUS PORRECTELLUS, Wlk. xxvii. 140. Amazons.

(13)†SCHŒNOBIUS LANCEOLELLUS, n. sp.

♀. Head and thorax brownish ochreous; abdomen whitish, tinged in places with ochreous. Fore wing with the costal area suffused with brown; two black discocellular spots; spots below base and middle of cell, an oblique series from apex to below angle of cell, and a postmedial spot above vein 1; a marginal series of specks. Hind wing almost pure white.

Another specimen has the spots of fore wing obsolescent.

Hab. Amazons (*Trail*). *Exp.* 40 mm.

(14) SCHŒNOBIUS MONTIVAGELLUS, Zell. Mon. Chil. & Cramb. p. 5.
Venezuela; Brazil.

(15) SCHŒNOBIUS LONGIROSTRELLUS, Clem. Contrib. v. p. 205.
N. America.

(16) SCHŒNOBIUS SORDIDELLUS, Zinck. Germ. Mag. iv. p. 247.
„ *dispersellus*, Rob. Grote's Check List, p. 56.
Florida.

(17)†SCHŒNOBIUS IMMANIS, Zell. Hor. Ent. Ross. xiii. p. 11, pl. i. f. 2. Buenos Ayres.

(18)†**Schœnobius majoralis**, n. sp.

♀. Head, thorax, and abdomen pale rufous brown; anal tuft whitish. Fore wing pale rufous brown, with an obscure series of dark specks from near apex to inner margin just beyond middle. Hind wing pure white.

Another specimen has a diffused dark rufous fascia from base through the cell to the oblique specks and apex.

Hab. Afghanistan. *Exp.* 42 mm.

(19)†**Schœnobius lineatus**, Butl. A. M. N. H. iv. p. 457. Japan.

(20)†**Schœnobius costalis**, Moore, Lep. Ceyl. iii. p. 388, pl. 184. f. 15. Ceylon.

List of undetermined Species.

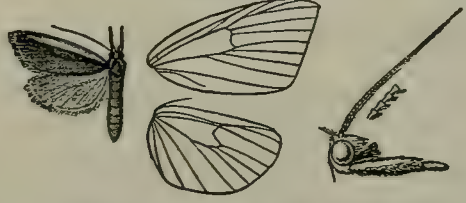
Schœnobius celidias, Meyr. Trans. Ent. Soc. 1894, p. 475. Borneo.
„ *tripunctellus*, Rob. Ann. Lyc. N. York, ix. 314. Texas.
„ *terreus*, Zell. Hor. Ent. Ross. xiii. 10. Madagascar.
„ *ochraceellus*, Snell. Midd.-Sum. iv. (1) 8, p. 79. Sumatra.
„ *vittatus*, Möschl. Verh. z.-b. Wien, xxxi. 435. Surinam.
„ *opalescalis*, Hulst, Tr. Am. Ent. Soc. xiii. p. 167. Arizona.
„ *chionotus*, Meyr. Tr. Ent. Soc. 1889, p. 519. New Guinea.
„ *maximellus*, Fern. Can. Ent. xxiii. p. 30. Texas.
„ *acutellus*, Ev. Europe.
„ *caminarius*, Zell. Micr. Caffr. p. 68. S. Africa.
„ *chrysostomus*, Zell. Micr. Caffr. p. 68. S. Africa.

Genus Donacaula.

Donacaula, Meyr. Trans. Ent. Soc. 1890, p. 466.

Palpi projecting about three times length of head and thickly scaled; maxillary palpi triangularly scaled; frons hairy; antennæ somewhat annulated and ciliated; abdomen long and slender; legs and spurs long. Fore wing with the apex rectangular in male, produced and acute in female; vein 3 from before angle of cell; 4, 5 from angle; 6 from below upper angle; 7 from angle; 8, 9, 10 stalked; 11 anastomosing with 12 or free. Hind wing with vein 3 from before angle of cell; 4, 5 well separated at origin; 6, 7 from upper angle, 7 anastomosing slightly with 8.

Fig. 20.



Donacaula mucronella, ♂. $\frac{1}{1}$.

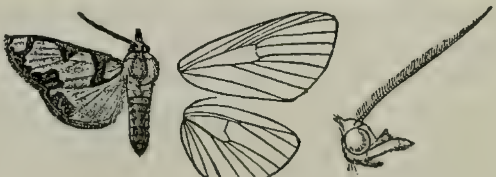
Type. **Donacaula mucronella**, Schiff. Europe.

Genus CIRRHOCHRISTA.

Cirrhochrista, Led. Wien. ent. Mon. 1863, p. 440.

Palpi porrect, thickly clothed with hair, the 3rd joint hidden by hair and downcurved; maxillary palpi long and triangularly scaled at extremity; frons oblique; antennæ ciliated; tibiæ clothed on outer side with rough hair, the outer spurs less than half the length of inner. Fore wing with the apex produced, the outer margin oblique; veins 3, 4, 5 from angle of cell; 7 curved and very closely approximated for a short distance to or well separated from 8, 9, to which 10 is approximated. Hind wing with veins 3, 4, 5 from angle of cell; 6, 7 shortly stalked.

Fig. 21.



Cirrhochrista pulchellalis, ♂. $\frac{1}{1}$.

SECT. I. Palpi projecting about the length of head and with a tuft of porrect hair from 1st joint.

Type. (1) CIRRHOCHRISTA ÆTHERIALIS, Led. Wien. ent. Mon. 1863, p. 441, pl. 17. f. 9. Amboina; Ternate.

(2) CIRRHOCHRISTA PULCHELLALIS, Led. Wien. ent. Mon. 1863, p. 441, pl. 17. f. 10. Ceylon; Java; Amboina.

(3)†CIRRHOCHRISTA SEMIBRUNNEA, n. sp.

♀. Head brown, with the vertex white; thorax and abdomen brown, the middle of collar, patagia, and basal segment of abdomen white. Fore wing brown, with a large white patch on basal inner area; a large crescentic white mark in cell, and much larger similar mark beyond the cell; a quadrate apical white patch; a yellow discocellular line and series of yellow marginal marks below the apical patch. Hind wing white; a large, round, brown submarginal spot between veins 2 and 5; some yellow on medial part of margin; a brown marginal line; cilia fulvous at base; inner area tinged with fuscous.

Hab. Bhután, India (*Dudgeon*). *Exp.* 36 mm.

SECT. II. Palpi projecting about twice the length of head and with no tuft from 1st joint.

(4)†CIRRHOCHRISTA BRIZOALIS, Wlk. xix. 976; Japan; China;
Moore, Lep. Atk. pl. 7. f. 10. Formosa; throughout India
Cirrhochrista figuràtalis, Wlk. and Ceylon; Borneo; Celebes;
xxxiv. 1369. Australia.

(5) CIRRHOCHRISTA FUMIPALPIS, Feld. Reis. Nov. pl. 135. f. 31.
Sikhim; Assam; Burma; Moluccas.

(6)†CIRRHOCHRISTA BRACTEOLALIS, Hmpsn. Ill. Het. viii. p. 135, pl. 155. f. 3.
Sikhim; S. India; Ceylon.

(7)†CIRRHOCHRISTA PUNCTULATA, n. sp.

♀. White; the palpi and a stripe on shoulders fulvous; tarsi banded with fulvous. Fore wing with a fulvous stripe on costa; a dark discocellular spot; medial and postmedial indistinct series of specks. Hind wing with indistinct postmedial series of specks; both wings with a dark marginal line expanding into specks at the veins.

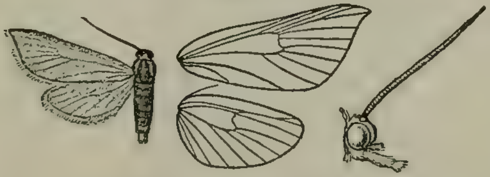
Hab. Rockhampton, Australia. *Exp.* 26 mm.

Genus ACENTROPUS.

Acentropus, Curt. Brit. Ent. iv. pl. 497 (1862).

Palpi projecting about twice the length of head and dilated with scales at extremity; maxillary palpi loosely scaled; frons rounded; antennæ thickened and annulate; tibiæ with the spurs minute. Fore wing long and narrow, the apex produced; vein 1 *b* short and not reaching outer angle; 2, 3, 4, 5 widely separated at origin; 6 from below upper angle; 7 from angle; 8, 9 stalked; 10, 11 free. Hind wing with veins 3, 4, 5 well separated at origin; 6, 7 from upper angle, 7 anastomosing with 8 almost to apex. Wings in female often much abbreviated or aborted.

Fig. 22.



Acentropus niveus, ♂. $\frac{2}{1}$.

Type. (1) ACENTROPUS NIVEUS, Olivier, Encycl. Méth. p. 536, t. vi.
W. Europe.
„ *hansoni*, Steph. Nomencl. 2 ed. Col. 118.
„ *garnonsii*, Curt. Brit. Ent. iv. pl. 497.

(2) ACENTROPUS NEWÆ, Kol. Wien. Monats. 1858, p. 382. Russia.

(3) ACENTROPUS LATIPENNIS, Möschl. Wien. Monats. 1860, p. 55.
Armenia.

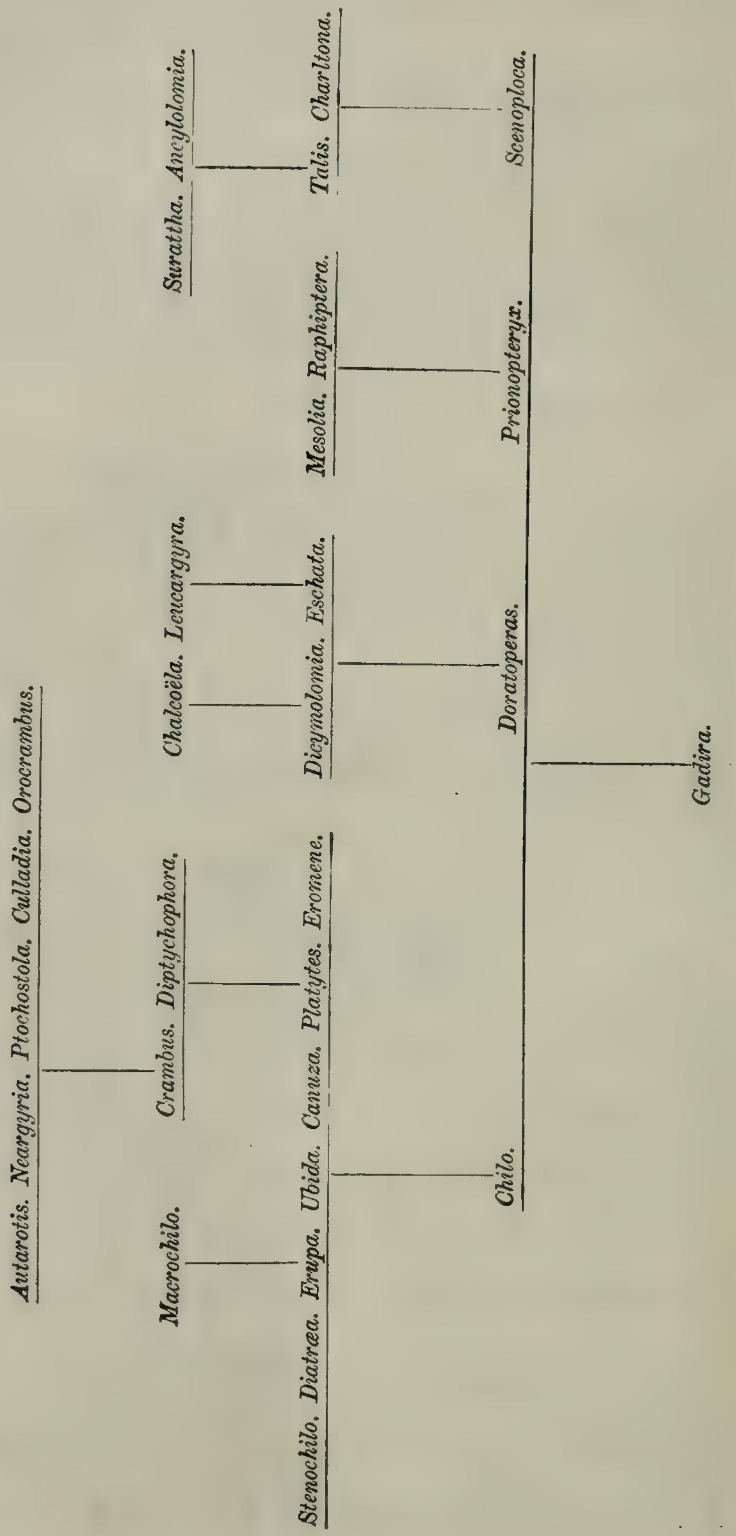
List of unrecognized Genera.

Idneodes tretopteralis, Rag. Ann. Soc. Ent. Fr. 1891, p. 605.
Brazil.

Alpherakia obnubilalis, Christ. Bull. Mosc. lvi. p. 32 (1881).
Amur.

Anœglis demissalis, Led. Wien. ent. Mon. 1863, p. 56, pl. 7. f. 1.
Brazil.

PHYLOGENY OF THE CRAMBINÆ.



Anœglis argentalis, Christ. Rom. Mem. iii. p. 106, pl. 5. f. 6. C. Asia.

Callasopia rosealis, Möschl. Lep. Porto Rico, p. 275. Porto Rico.

Parasopia dissimilalis, Möschl. Lep. Porto Rico, p. 275. Porto Rico.

Subfamily CRAMBINÆ.

Proboscis often absent or minute; palpi porrect; the maxillary palpi well developed and triangularly dilated with scales. Fore wing with vein 7 present[*]; vein 1 *a* separate from 1 *b*. Hind wing with the median nervure pectinated on upperside; vein 7 almost always anastomosing with 8.

The larvæ are usually grass or reed feeders.

Of the subfamilies of Pyralidæ that have the median nervure pectinated, the *Crambinæ* may be distinguished from the *Phycitinæ* and *Anerastiinæ* by the presence of vein 7 of the fore wings[*]; from the *Galleriinæ* by vein 1 *a* being separate from 1 *b* instead of forming a fork with it, also by the labial palpi being well developed in the male instead of almost obsolete, and the maxillary palpi triangularly scaled; from the *Oxychirotinæ* by having the outer spurs of mid and hind tibiæ well developed instead of absent, and also by the very different shape of the wings. Whilst in the few genera of *Pyraustinæ* and *Scopariinæ* that have the median nervure pectinated, the very different form of the labial and maxillary palpi will at once serve as a distinction.

Key to the Genera.

A. Hind wing with vein 6 from upper angle of cell.
[†] *a*. Fore wing with veins 7, 8 stalked, 10 from cell.
  *a*¹. Hind wing with the upper margin of the cell approximated to 8; fore wing with the apical area not produced.
    *a*². Both wings with vein 3 present.
      *a*³. Fore wing with veins 2, 3 stalked .... 1. *Autarotis.*
      *b*³. Fore wing with veins 2, 3 from cell.
        *a*⁴. Thorax below and coxæ smooth.
          *a*⁵. Fore wing with veins 10, 11 stalked...... 2. *Neargyria.*
          *b*⁵. Fore wing with veins 10, 11 from cell... 6. *Crambus.*
        *b*⁴. Thorax below and coxæ hairy .... 5. *Orocrambus.*
    *b*². Both wings with vein 3 absent...................... 3. *Ptochostola.*
  *b*¹. Hind wing with the upper margin of the cell remote from 8; fore wing with the apical area produced to a rounded prominence.................. 23. *Mesolia.*
b. Fore wing with vein 7 absent .... 4. *Culladia.*
[‡] *c*. Fore wing with veins 7 and 10 from cell.
  *a*¹. Palpi extending once to three times length of head.
    *a*². Fore wing with veins 6, 7 from cell.
      *a*³. Frons rounded and not prominent.
        *a*⁴. Proboscis well developed; palpi with the 3rd joint clothed with hair.
          *a*⁵. Hind wing with veins 4, 5 from a point. 8. *Platytes.*
          *b*⁵. Hind wing with veins 4, 5 well separated at origin .... 7. *Diptychophora.*

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[*] Except in *Culladia* and *Mesolia apistrigella*.

[†] In *Mesolia apistrigella* vein 7 of the fore wing is absent.

[‡] In a few specimens of *Eschata* 7 is shortly stalked with 8, 9.

b^4. Proboscis absent or minute.
a^5. Palpi with the 3rd joint clothed with hair; antennæ of male bipectinate ...... 15. *Ubida.*
b^5. Palpi with the 3rd joint naked; antennæ of male not pectinated.
a^6. Palpi extending about twice the length of head, with a tuft of hair from below 1st joint .... 17. *Chalcoëla.*
b^6. Palpi extending about the length of head, with tufts of hair below 1st and 2nd joints .... 18. *Dicymolomia.*
b^3. Frons with a conical prominence.
a^4. Fore wing with vein 11 oblique.
a^5. Fore wing subtriangular; ♂ with a shallow fovea in cell .... 9. *Eromene.*
b^5. Fore wing lanceiform, the costa arched towards apex .... 10. *Canuza.*
b^4. Fore wing with vein 11 curved and approximated to 12, the apex produced and acute .... 16. *Chilo.*
c^4. Fore wing with vein 11 becoming coincident with 12 .... 14. *Diatræa.*
b^2. Fore wing with veins 6, 7 stalked .... 11. *Stenochilo.*
b^1. Palpi not or hardly extending beyond the frontal projection.
a^2. Fore wing broad; veins 8, 9 from angle of cell. 20. *Eschata.*
b^2. Fore wing long and narrow; veins 6, 7 from angle of cell, 8, 9 from before angle .... 21. *Doratoperas.*
d. Fore wing with veins 7, 8, 9, 10 stalked.
a^1. Palpi extending about one and a half times length of head .... 12. *Macrochilo.*
b^1. Palpi not extending beyond frontal projection ... 19. *Leucargyra.*
e. Fore wing with veins 8, 9, 10 stalked, 7 from cell; palpi about three times length of head .... 13. *Erupa.*

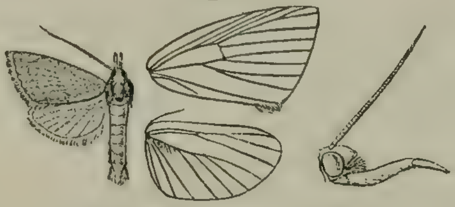
B. Hind wing with vein 6 from well below angle of cell and rudimentary, or absent.
a. Fore wing with the apical area produced to a rounded or hooked prominence .... 24. *Prionopteryx.*
b. Fore wing with the apical area not produced.
a^1. Fore wing with veins 7 and 11 absent .... 22. *Raphiptera.*
b^1. Fore wing with veins 7 and 11 present.
a^2. Fore wing with vein 7 from the cell.
a^3. Hind wing with vein 5 present.
a^4. Frons rounded or flat and not prominent.
a^5. Hind wing with veins 4, 5 shortly stalked, a tuft of raised scales at lower angle of cell .... 30. *Gadira.*
b^5. Hind wing with veins 4, 5 from angle of cell.
a^6. Fore wing with vein 11 oblique; palpi with the 3rd joint naked; female with aborted wings .... 29. *Scenoploca.*
b^6. Fore wing with vein 11 curved and approximated to 12; palpi with the 3rd joint clothed with hair; female with the wings fully developed ...... 28. *Charltona.*
b^4. Frons with a conical prominence .... 27. *Talis.*
b^3. Hind wing with vein 5 absent .... 25. *Surattha.*
b^2. Fore wing with vein 7 stalked with 8, 9 .... 26. *Ancylolomia.*

Genus Autarotis.

Autarotis, Meyr. Trans. Ent. Soc. 1886, p. 269.

Palpi extending about three times the length of head and thickly clothed with hair; maxillary palpi triangularly scaled; proboscis well developed; frons with a conical prominence; antennæ of male somewhat thickened and flattened; tibiæ smoothly scaled, the outer spurs about twice the length of inner. Fore wing with the apex somewhat acute; veins 2, 3 stalked; 4, 5 from angle of cell; 6 from below upper angle; 7, 8, 9 stalked; 10, 11 free: male with the inner margin fringed with long rough hair towards outer angle. Hind wing with vein 3 from near angle of cell; 4, 5 from angle; 6, 7 from upper angle.

Fig. 23.



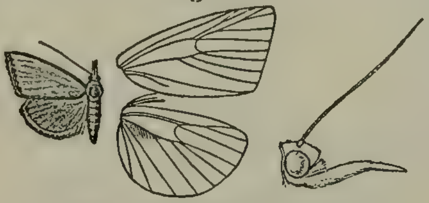
Autarotis euryala, ♂. 1/1.

Type. Autarotis euryala, Meyr. Trans. Ent. Soc. 1886, p. 207. Fiji.

Genus Neargyria, nov.

Palpi extending about three times length of head and clothed with hair; maxillary palpi triangularly scaled; proboscis well developed; frons with a conical prominence; antennæ of female nearly simple; tibiæ smoothly scaled, the spurs long. Fore wing with the apex produced and acute; vein 3 from before angle of cell; 4, 5 from angle; 6 from upper angle; 7, 8, 9 stalked; 10, 11 stalked. Hind wing with vein 3 from before angle of cell; 4, 5 from angle; 6, 7 from upper angle.

Fig. 24.



Neargyria argyraspis, ♀. 1/1.

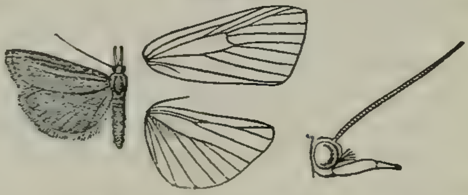
Type. Neargyria argyraspis, Meyr. P. Linn. Soc. N. S. W. 1879, p. 216. Australia.

Genus Ptochostola.

Ptochostola, Meyr. P. Linn. Soc. N. S. W. vii. p. 154 (1882).

Palpi porrect, clothed with hair, and extending about twice the length of head; maxillary palpi triangularly scaled; proboscis well developed; frons rounded; antennæ of male thickened and flattened; tibiæ with the spurs long. Fore wing with vein 3 absent; 4, 5 usually from angle of cell; 6 from below upper angle; 7, 8, 9 stalked; 10 free. Hind wing with vein 3 absent; 4, 5 from angle; 6, 7 from upper angle.

Fig. 25.



Ptochostola microphœella, ♂. $\frac{3}{2}$.

Sect. I. Fore wing with vein 11 becoming coincident with 12.

Type. (1)†Ptochostola microphœella, Wlk. xxxv. 1758. Australia.
Crambus dimidiellus, Meyr. P. L. Soc. N. S. W. 1878, p. 190.

Sect. II. Fore wing with vein 11 free.

A. Fore wing with veins 4, 5 from cell.

(2)†Ptochostola incanella, Zell. Hor. Ent. Ross. xvi. p. 50. Colombia.

B. Fore wing with veins 4, 5 stalked.

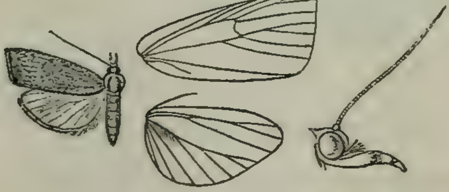
(3)†Ptochostola pygmæus, Zell. Hor. Ent. Ross. xvi. p. 173, pl. xi. f. 10. Colombia.

Genus Culladia.

Culladia, Moore, Lep. Ceyl. iii. p. 383.

Palpi porrect, thickly scaled, and extending about twice the length of head; maxillary palpi triangularly scaled; frons rounded; antennæ of male somewhat thickened and flattened; spurs long and equal. Fore wing long and narrow; vein 3 from angle of cell; 6 from below upper angle; 7 absent; 8, 9 stalked; 10, 11 free. Hind wing with vein 3 from near angle of cell; 6, 7 from upper angle.

Fig. 26.



Culladia admigratella, ♂. $\frac{3}{2}$.

Sect. I. Both wings with veins 4, 5 stalked.

Type. (1)†Culladia admigratella, Wlk. xxvii. 192; C. & S. no. 4686. China; Ceylon; Borneo.
†*Araxes æsella*, Wlk. xxvii. 193; C. & S. no. 4687.
Crambus troglodytellus, Snell. Tijds. Ent. (2) vii. p. 103, pl. 8. f. 6.

Sect. II. Both wings with veins 4, 5 coïncident.

(2) **Culladia suffusella**, n. sp.

Head, thorax, and abdomen brownish fuscous. Fore wing fuscous; the costal area brownish; the veins beyond lower angle of cell streaked with fuscous; traces of a submarginal series of dark specks; a marginal series of dark specks, Hind wing pale, the costal and apical areas tinged with fuscous.

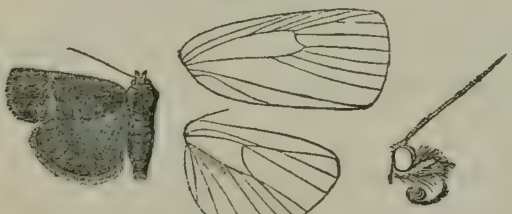
Hab. Madagascar; Nilgiris (*Hampson*). *Exp.* 20–26 mm.

Genus Orocrambus.

Orocrambus, Meyr. Tr. N. Z. Inst. xx. p. 67 (1885).

Palpi porrect, extending about the length of head and fringed with long hair below; maxillary palpi triangularly scaled; frons rounded; antennæ of female almost simple; thorax below and coxæ hairy; build stout; wings broad. Fore wing with the apex rounded; vein 3 from before angle of cell; 4, 5, from angle; 6 from upper angle; 7, 8, 9 stalked, or 9 free; 10, 11 free. Hind wing with vein 3 from before angle of cell; 4, 5 from angle; 6, 7 from upper angle; 7 anastomosing with 8 or free.

Fig. 27.



Orocrambus melampetrus, ♀. $\frac{1}{1}$.

Type. (1) O. **melampetrus**, Purdie, N. Z. Journ. Sci. ii. p. 168. New Zealand.

(2) O. **catacaustus**, Meyr. Tr. N. Z. Inst. xvii. p. 134. New Zealand.

(3) O. **tritonellus**, Meyr. Tr. N. Z. Inst. xvii. p. 134. New Zealand.

Undetermined Species.

Orocrambus mylites, Meyr. Tr. N. Z. Inst. xx. p. 67. New Zealand.

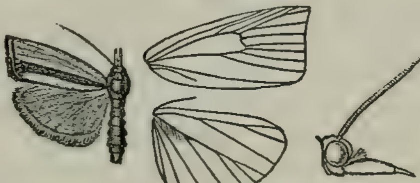
Genus Crambus.

Crambus, Fabr. Ent. Syst. Suppl. p. 464 (1798).
Chrysoteuchia, Hübn. Verz. p. 366 (? 1818).
Thisanotia, Hübn. Verz. p. 367.
Exoria, Hübn. Verz. p. 367.
Carvanca, Wlk. ix. p. 119 (1856).
Calamotropha, Zell. Mon. Chil. & Cramb. p. 8 (1863).
Myeza, Wlk. xxvii. 190 (1863).

Arequipa, Wlk. xxvii. 195.
Propexus, Grote, Can. Ent. xii. p. 79 (1880).

Palpi porrect, extending about three times the length of head, and clothed with long hair; maxillary palpi triangularly dilated with hair; frons rounded; antennæ of male usually thickened and flattened, with appressed serrations; tibiæ with the outer spurs about half the length of inner. Fore wing with the apex acute; vein 3 from before angle of cell; 4, 5 usually from angle; 7, 8, 9 stalked; 10 free; 11 curved and approximated to or becoming coincident with 12. Hind wing with vein 3 from near angle of cell; 4, 5 from angle of cell or stalked.

Fig. 28.



Crambus nivellus, ♂. $\frac{1}{1}$.

SECT. I. (*Propexus*). Antennæ of male bipectinate, with long branches.

(1)†CRAMBUS EDONIS, Grote, Can. Ent. xi. p. 19. U.S.A.

(2)†CRAMBUS PEXELLUS, Zell. Mon. Chil. & Cramb. p. 48. U.S.A.

(3)†CRAMBUS PECTINIFER, Zell. Hor. Ent. Ross. xiii. p. 53, pl. i. f. 20 *a*, *b*. U.S.A.

SECT. II. Antennæ of male strongly serrate.

4)†CRAMBUS REPANDUS, Grote, Can. Ent. xi. p. 79. Colorado.

SECT. III. (*Crambus*). Antennæ of male slightly thickened and flattened.

A. Fore wing with vein 7 given off further from the apex than 9.
  a. Fore wing with vein 11 curved and approximated to 12.
    a^1. Fore wing with veins 4, 5 from cell.
      a^2. Palpi extending about twice the length of head.

(5)†CRAMBUS TONSALIS, Wlk. xxvii. 190. Borneo.

(6) CRAMBUS DIELOTA, Meyr. Trans. Ent. Soc. 1886, p. 268. Ceram; Australia; Fiji.

(7)†CRAMBUS ANTICELLUS, Wlk. xxxv. 1751. Natal; Travancore; Ceylon; Pt. Darwin, Australia.

(8)†CRAMBUS INFIXELLUS, Wlk. xxvii. 167. Japan; China.

(9) CRAMBUS PALUDELLUS, Hübn. Europe.

(10)†CRAMBUS HIEROCHUNTICUS, Zell. Palestine.

(11) **Crambus leptogrammellus**, Meyr. P. Linn. Soc. N. S. W. iv. p. 207. Australia.

(12)†**Crambus delatalis**, Wlk. xxvii. 176. Ceylon; Australia.

(13)†**Crambus atkinsoni**, Zell. Mon. Chil. & Cramb. p. 9. India; Ceylon; Burma; Borneo.

(14)†**Crambus albistrigellus**, n. sp.

♂. Head whitish, slightly suffused with brown; thorax pale reddish brown; abdomen whitish, slightly suffused with brown. Fore wing grey, irorated with brown; the costal area reddish brown; the cell, the veins beyond it, and the inner area prominently grey; a black discocellular speck; a brown spot at origin of vein 2; a marginal series of specks. Hind wing whitish, slightly suffused with brown.

Hab. Bonin Island, Perry's group. *Exp.* 24 mm.

(15) **Crambus dividellus**, Snell. Trans. Ent. Soc. 1890, p. 645. Sikhim.

(16) **Crambus unicolorellus**, Zell. Mon. Chil. & Cramb. p. 7.
† „ *abbreviatellus*, Wlk. xxxv. 1756. Punjab; Nilgiris.

(17)†**Crambus violescentellus**, n. sp.

Head and thorax pale ochreous; patagia purplish; abdomen whitish. Fore wing with the basal half of costa ochreous; the inner area ochreous white, with diffused black scales above it; the veins pale fulvous; an orange postmedial slightly sinuous line bent inwards to costa; a slightly sinuous submarginal orange line; a marginal series of black specks, sometimes complete, sometimes reduced to the medial four which are placed on an ochreous patch; cilia silvery. Hind wing pure white.

Hab. São Paulo; Castro Paraña, Brazil (*Jones*). *Exp.* 24–28 mm.

(18)†**Crambus aurantilineellus**, n. sp.

Head, thorax, and abdomen ochreous white. Fore wing purplish grey; a white streak from base along median nervure to outer margin; a diffused orange-yellow band below median nervure; orange postmedial and submarginal bands from the white streak to inner margin; a marginal series of black specks, the three below middle on an orange patch.

Hab. São Paulo, Brazil (*Jones*). *Exp.* 30 mm.

(19)†**Crambus hemixanthellus**, n. sp.

Head and thorax orange; abdomen whitish. Fore wing with the costal area dark rufous, merging into grey on outer area; the inner area orange, with two dark medial and two postmedial patches; a minutely dentate submarginal dark line outwardly edged with white towards inner margin; a marginal series of black specks; the cilia grey. Hind wing pure white.

Hab. São Paulo, Brazil (*Jones*). *Exp.* 26 mm.

(20)*CRAMBUS ALEXANDRIENSIS, Baker, Trans. Ent. Soc. 1894, p. 48, pl. i. f. 19. Egypt.

(21)†CRAMBUS TENUISTRIGATUS, Zell. Hor. Ent. Ross. xvi. p. 168, pl. ii. f. 8. Trinidad; Colombia.

(22)†CRAMBUS INORNATELLUS, Wlk. xxvii. 157. Nova Scotia.

(23)†CRAMBUS MINUELLUS, Wlk. xxvii. 164. Colombia.

(24)†CRAMBUS LIGONELLUS, Zell. Hor. Ent. Ross. xvi. p. 170, pl. xi. f. 9. Jamaica.

(25) CRAMBUS TETERELLUS, Zinck. Germ. Mag. iv. p. 252. U.S.A.
„ *camurellus*, Clem. P. A. N. S. Phil. 1860, p. 203.
„ *terrellus*, Zell. Mon. Chil. & Cramb. p. 27.

(26)†CRAMBUS CUNEIFERELLUS, Wlk. xxvii. 175. Australia; New Hebrides; Norfolk Island.

(27) CRAMBUS COMBINELLUS, Schiff. Europe.

(28) CRAMBUS COULONELLUS, Dup. Europe.

(29) CRAMBUS SPURIELLUS, Hübn. Europe.

(30)†CRAMBUS DIPLOGRAMMUS, Zell. Mon. Chil. & Cramb. p. 25. Siberia; Japan.
„ *textellus*, Christ. Bull. Mosc. lvi. p. 48.
„ *argentistrigellus*, Leech, Entom. xxii. p. 107, pl. v. f. 11.

(31)*CRAMBUS STRIATELLUS, Leech, Entom. xxii. p. 107, pl. v. f. 3. Japan.

(32) CRAMBUS PUDIBUNDELLUS, H.-S. Europe.

(33) CRAMBUS FASCELINELLUS, Hübn. Europe.
„ *ramosellus*, Zell. Mon. Chil. & Cramb. p. 35.
„ *epineurus*, Meyr. Ent. Mo. Mag. xx. p. 141.

(34) CRAMBUS DIGITELLUS, H.-S. Europe.

(35)†CRAMBUS TRISECTUS, Wlk. ix. 119. U.S.A.
† „ *exsiccalis*, Zell. Mon. Chil. & Cramb. p. 37.
† „ *interminellus*, Wlk. xxvii. 156.

(36)†CRAMBUS UNDATUS, Grote, Can. Ent. xvi. p. 35. U.S.A.

(37)†CRAMBUS LACINIELLUS, Grote, Can. Ent. xi. p. 18. U.S.A.

(38) CRAMBUS CALIGINOSELLUS, Clem. P. A. N. S. Phil. 1860, p. 203. U.S.A.

(39)†CRAMBUS ANCEPS, Grote, Can. Ent. xi. p. 18. U.S.A.

(40)†CRAMBUS DUPLICATUS, Grote, Can. Ent. xiii. p. 79. U.S.A.

(41) CRAMBUS MUTABILIS, Clem. Proc. A. N. S. Phil. 1860, p. 204. U.S.A.
† „ *fuscicostellus*, Zell. Mon. Chil. & Cramb. p. 44.

(42)†CRAMBUS PROFANELLUS, Wlk. xxxv. 1753. Jamaica.

(43)†CRAMBUS FISSIRADIELLUS, Wlk. xxvii. 160. W. Indies.
† „ *curtellus*, Wlk. xxvii. 160. Colombia; Argentina.
† „ *quadrinotellus*, Zell. Hor. Ent. Ross. xiii. p. 55, pl. i. f. 21.

(44) CRAMBUS LUTEOLELLUS, Clem. Proc. A.N.S. Phil. 1860, p. 203.
† „ *hemiochrellus*, Zell. Ex. Micr. p. 49. U.S.A.
„ *ulæ*, Cockerell, Ent. Mo. Mag. xxiv. p. 272.

(45)†CRAMBUS BIZONELLUS, n. sp.

♂. Yellowish brown. Fore wing with the inner area suffused with dark brown; a narrow obliquely curved medial red-brown band; a similar minutely dentate postmedial band; a marginal series of black specks; cilia fuscous. Hind wing fuscous.

Hab. Valparaiso (*J. J. Walker*). *Exp.* 24 mm.

(46)†CRAMBUS DECOLORELLUS, Wlk. xxvii. 164. Cape.
† „ *figuratellus*, Wlk. xxxv. 1754.

(47)†CRAMBUS FULVITINCTELLUS, n. sp.

♂. Head and thorax ochreous; palpi fulvous at sides; abdomen fuscous. Fore wing ochreous, with a fulvous tinge and irrorated with fuscous; the costal and outer areas fuscous; very ill-defined oblique medial and postmedial bands from costal area to inner margin; an indistinct curved submarginal line. Hind wing pale fuscous; the cilia whitish.

Hab. Amshaw, S. Africa. *Exp.* 24 mm.

(48) CRAMBUS ACUTANGULUS, H.-S. Europe.

(49)†CRAMBUS PALEATELLUS, Zell. Europe.

(50) CRAMBUS TRABEATELLUS, H.-S. Sicily.

(51) CRAMBUS INQUINATELLUS, Schiff. Europe.

(52)*CRAMBUS SUBFLAVELLUS, Dup. Europe.

(53)*CRAMBUS OSELLUS, Staud. Europe.

(54) CRAMBUS ATLANTICUS, Wollaston, A. M. N. H. (3) i. p. 119. Madeira.
„ var. *canariensis*, Rebel. Ann. Hofmus. Wien, vii. p. 254, pl. xvii. ff. 11, 12. Canaries.

(55) CRAMBUS TERSELLUS, Led. Europe.

(56) CRAMBUS DESERTELLUS, Led. Europe.

(57)*CRAMBUS GRAMMICULELLUS, Lucas, Explor. Algérie, iii. p. 407, pl. 4. f. 8. Algiers.

(58) CRAMBUS GENICULEUS, Haw. Europe; Japan.

(59) CRAMBUS CONTAMINELLUS, Hübn. Europe.
„ *cantiellus*, Tutt, Ent. xix. p. 52.

(60) Crambus salinellus, Tutt. Ent. xix. p. 52. England.

(61) Crambus matricellus, Treit. Europe.

(62) Crambus poliellus, Treit. Europe.

(63) Crambus deliellus, Hübn. Europe.

(64) Crambus lithargyrellus, Hübn. Europe.

(65) Crambus tristellus, Fabr. Europe.

(66) Crambus selasellus, Hübn. Europe.

(67) Crambus luteellus, Schiff. Europe.

(68)†Crambus zermattensis, Frey. Europe.

(69) Crambus lævigatus, Led. Europe.

(70) Crambus perlellus, Scop. Europe.
† „ *languidellus*, Zell. Mon. Chil. & Cramb. p. 49.

(71) Crambus aureliellus, F. R. Europe.

(72) Crambus saxonellus, Zinck. Europe.

(73) Crambus fulgidellus, Hübn. Europe.

(74) Crambus latistrius, Haw. Europe.

(75) Crambus unistriatellus, Pack. Proc. B. S. N. H. ii. 32. U.S.A.
† „ *exesus*, Grote, Can. Ent. xi. 16.

(76)†Crambus xiphiellus, Zell. S. e. Z. 1872, p. 467, pl. 2. f. 1.
Bogotá.

(77)†Crambus falklandicellus, n. sp.

Pale golden brown; palpi white below. Fore wing with a white streak along basal half of costa, and a somewhat broad fascia from base through the cell to outer margin below apex. Hind wing somewhat paler.

Hab. Falkland Islands. *Exp.* 28 mm.

(78)†Crambus falcarius, Zell. S. e. Z. 1872, p. 469, pl. 2. f. 2.
Bogotá.

(79) Crambus euryptellus, Berg, Ann. Soc. Argent. iv. p. 208.
Argentina; Patagonia.

(80)†Crambus straminellus, n. sp.

♂. Brownish ochreous; palpi fuscous, white below. Fore wing with two medial brown lines from vein 1 to inner margin; a few brown scales on the outer part of inner area; an indistinct submarginal brown line highly angled at vein 6; a short oblique line from apex which is produced to a point; three or four marginal black specks. Hind wing ochreous white.

Hab. Valparaiso (*J. J. Walker*). *Exp.* 26 mm.

(81)†Crambus chillanicus, Butl. Trans. Ent. Soc. 1883, p. 61.
Chili.

(82)†CRAMBUS RADICELLUS, n. sp.

♂. Golden brown. Fore wing with a somewhat broad white fascia below costa forking towards apex; a similar fascia through the cell with a longer fork before outer margin, and a streak between it and the subcostal fascia; a dark line on apical part of margin and three specks on medial part; the inner area greyish. Hind wing pale brown.

Hab. Patagonia (*J. J. Walker*). *Exp.* 30 mm.

(83)†CRAMBUS FERNANDESELLUS, n. sp.

♂. Pale ochreous; thorax suffused with brown; abdomen whitish. Fore wing with brown streaks on base of costa; brown streaks below end of subcostal nervure and below the veins beyond the cell; a white streak on median nervure and a brown fascia below it; some brown suffusion on inner area. Hind wing whitish, with slight fuscous suffusion.

Hab. Juan Fernandez (*J. J. Walker*). *Exp.* 30 mm.

(84)†CRAMBUS SPICULELLUS, Zell. Hor. Ent. Ross. xiii. p. 35, pl. i. f. 14. Argentina.

(85)†CRAMBUS DIATRÆELLUS, n. sp.

Brownish ochreous. Fore wing with black specks on discocellulars and on vein 2 near origin; the veins and interspaces of outer area streaked with brown; two fine brown lines just inside the margin and a fine marginal black line; the apex produced and acute. Hind wing pale fuscous.

Hab. Cayenne; Goya, Argentina. *Exp.* ♂ 28, ♀ 36 mm.

(86)†CRAMBUS VAPIDUS, Butl. P. Z. S. 1877, p. 399. New Zealand.

(87) CRAMBUS DECRENELLUS, Meyr. N. Z. Journ. Sci. i. p. 186. New Zealand.

(88) CRAMBUS CRENŒUS, Meyr. Tr. N. Z. Inst. xvi. p. 135. New Zealand.

(89) CRAMBUS HAPLOTOMUS, Meyr. N. Z. Journ. Sci. i. p. 187. New Zealand.

(90) CRAMBUS PEDIAS, Meyr. Trans. N. Z. Inst. xvii. p. 137. New Zealand.

(91) CRAMBUS ENCOPHORUS, Meyr. Trans. N. Z. Inst. xvii. p. 136. New Zealand.

(92)†CRAMBUS VITELLUS, Doubl. Dieff. New Zeal. ii. p. 289. New Zealand.

† „ *transcissalis*, Wlk. xxvii. 178.
† „ *sublicellus*, Zell. Mon. Chil. & Cramb. p. 31.

(93)†CRAMBUS RAMOSELLUS, Doubl. Dieff. New Zeal. ii. p. 288. New Zealand.

„ *rangona*, Feld. Reis. Nov. pl. 137. f. 25.

(94)†CRAMBUS ANGUSTIPENNIS, Zell. Hor. Ent. Ross. xiii. p. 15.
New Zealand
† „ *leucanialis*, Butl. P. Z. S. 1877, p. 401.

(95)†CRAMBUS BISECTELLUS, Zell. Mon. Chil. & Cramb. p. 32.
New Zealand.
† „ *incrassatellus*, Zell. Mon. Chil. & Cramb. p. 32.
† „ *nexalis*, Wlk. xxvii. 178.

(96)†CRAMBUS FLEXUOSELLUS, Doubl. Dieff. New Zeal. ii. p. 289.
New Zealand.

(97) CRAMBUS TUHUALIS, Feld. Reis. Nov. pl. 137. f. 18.
New Zealand.
† „ *vulgaris*, Butl. P. Z. S. 1877, p. 400, pl. 43. f. 7.

(98) CRAMBUS XANTHOGRAMMUS, Meyr. N. Z. Journ. Sci. i. p. 187.
New Zealand.

(99)*CRAMBUS HARPOPHORUS, Meyr. N. Z. Journ. Sci. i. p. 187.
New Zealand.

(100)†CRAMBUS CORRUPTUS, Butl. P. Z. S. 1877, p. 399.
New Zealand.

(101) CRAMBUS HELIOTIS, Meyr. Tr. N. Z. Inst. xx. p. 68.
New Zealand.

(102) CRAMBUS CYCLOPICUS, Meyr. N. Z. Journ. Sci. i. p. 187.
New Zealand.

(103) CRAMBUS RADIELLUS, Hübn. Europe.

(104) CRAMBUS FURCATELLUS, Zett. Europe.

(105) CRAMBUS MARGARITELLUS, Hübn. Europe.

(106) CRAMBUS PYRAMIDELLUS, Treit. Europe.

(107) CRAMBUS PAUPERELLUS, Treit. Europe.

(108) CRAMBUS CONCHELLUS, Schiff. Europe.

(109) CRAMBUS PINELLUS, Linn. Europe.

(110) CRAMBUS MYTILELLUS, Hübn. Europe.

(111) CRAMBUS MYELLUS, Hübn. Europe.

(112)†CRAMBUS LATIRADIELLUS, Wlk. xxvii. 157. U.S.A.
† „ *interruptus*, Grote, Can. Ent. ix. p. 101.

(113) CRAMBUS SPECULALIS, Hübn. Europe.

(114) CRAMBUS LUCTIFERELLUS, Hübn. Europe.

(115)*CRAMBUS DIMORPHELLUS, Staud. Hor. Ent. Ross. xvi. p. 21.
Europe.

(116)*CRAMBUS CORSICELLUS, Dup. Europe.

(117)*CRAMBUS KOBELTI, Saalm. S. e. Z. xlvi. p. 335. f. 12. Algeria.

(118) CRAMBUS INCERTELLUS, H.-S. Europe.
„ *confusellus*, Staud. Hor. Ent. Ross. xvi. p. 82.

(119) CRAMBUS VERELLUS, Zinck. Europe.

(120) CRAMBUS FALSELLUS, Schiff. Europe.

(121) CRAMBUS TRICHOSTOMUS, Christ. Europe; Labrador; Canada.

(122) CRAMBUS LABRADORIENSIS, Christ. Ent. Zeit. xix. p. 314. Labrador; Canada.
† „ *mœstellus*, Wlk. xxvii. 155.

(123) CRAMBUS TRUNCATELLUS, Zett. Europe; Canada.
† „ *abtrusellus*, Wlk. xxvii. 158.
†*Hypena rufinalis*, Wlk. xxxiv. 1133.
†*Crambus licnigiellus*, Zell.

(124)†CRAMBUS MIXTALIS, Wlk. xxvii. 166. China.

(125)†CRAMBUS MACULALIS, Zett. Europe.
† „ *cacuminellus*, Zell.

(126) CRAMBUS BIARMICUS, Tgstn. Europe.

(127) CRAMBUS ELEGANS, Clem. Proc. A. N. S. Phil. 1860, p. 204. U.S.A.
† „ *terminellus*, Zell. Mon. Chil. & Cramb. p. 27.

(128)†CRAMBUS GRISETINCTELLUS, n. sp.

♂. Greyish white; thorax and abdomen suffused with brown. Fore wing sparsely irrorated with brown scales; the costa brown; brown specks on discocellulars and below origin of vein 2; an ill-defined diffused brown submarginal line becoming obsolescent towards inner margin; a marginal series of dark specks. Hind wing white, with a slight fuscous tinge. Underside of fore wing suffused with fuscous.

Hab. Petropolis, Brazil. *Exp.* 16 mm.

(129)†CRAMBUS EXPANSELLUS, Zell. Hor. Ent. Ross. 1877, pl. i. f. 18. Colombia.

(130)†CRAMBUS IMMUNELLUS, Zell. S. e. Z. 1872, p. 472, pl. 2. f. 6. Colombia; Brazil.

(131)†CRAMBUS PUSIONELLUS, Zell. Mon. Chil. & Cramb. p. 16. Colombia; Venezuela.

(132)†CRAMBUS SPARSELLUS, Wlk. xxxv. 1755. S. Africa.

(133)†CRAMBUS ŒNESCENTELLUS, n. sp.

♂. Head white; base of palpi and antennæ brown; thorax brown, the patagia white; abdomen white. Fore wing white; an æneous fascia along basal two-thirds of costa, and broader fasciæ below median nervure and on inner margin; a fascia in end of cell, then bent upwards to apex; a series of marks in the interspaces beyond lower angle of cell; a marginal line. Hind wing white, the costal area with a slight æneous tinge.

♀ with the fore wing more wholly suffused with bronze.

Hab. N'gatana, Brit. E. Africa(*Gregory*). *Exp.* 16 mm.

(134)†Crambus famulellus, Wlk. xxxv. 1765. Ceylon; Burma; Tonkin.

(135)†Crambus dileucellus, n. sp.

♀. Golden brown. Fore wing with a diffused white fascia in the cell connected with a diffused triangular patch on the disk; a white mark on the disk and white mark on middle of inner area; a dentate white submarginal line bent inwards at costa; an irregular white band just inside the margin; a dark marginal line; the cilia pale and brown. Hind wing fuscous; the cilia white.

Hab. Sarawak, Borneo. *Exp.* 20 mm.

(136)†Crambus obliterans, Wlk. xxvii. 169. Borneo.
† „ *candifer*, Wlk. xxvii. 170.

(137)†Crambus punctivenellus, n. sp.

♂. White; palpi fulvous at sides; thorax and abdomen irrorated with brown. Fore wing with the interspaces suffused with brown scales, leaving the base of cell and costal area whitish; a black spot at origin of vein 2; an oblique medial brown striga from costa; an indistinct submarginal brown line, double and very highly angled below the costa; a marginal black line somewhat maculate at the veins. Hind wing white.

Hab. Ceylon (*Green*); Tonkin (*Buckland*). *Exp.* 20 mm.

(138)†Crambus duplicellus, n. sp.

Silvery white; palpi at sides, antennæ, and legs fuscous. Fore wing with the costa dark brown; a brown medial line very much excurved below costa, then inwardly oblique, interrupted and emitting a streak below vein 2 to the double postmedial line, which is bent outwards from the costa to vein 6 and then becomes submarginal, and with some brown suffusion inside it on inner area; a dark marginal line. Underside of fore wing and costa of hind wing suffused with fuscous.

Hab. Haiphong, Tonkin (*Buckland*). *Exp.* 14 mm.

(139) Crambus chrysonuchellus, Scop. Europe.

(140) Crambus craterellus, Scop. Europe.

(141) Crambus lucellus, H.-S. Europe; Japan.

(142) Crambus hortuellus, Hübn. Europe; Japan.

(143) Crambus morrisonellus, Zell. U.S.A.

(144) Crambus decorellus, Zinck. Germ. Mag. iv. p. 256. U.S.A.
,, *polyactinellus*, Zell. Mon. Chil. & Cramb. p. 25.
† ,, *goodellianus*, Grote, Can. Ent. xii. p. 17.
,, *bonusculalis*, Hulst. Tr. Am. Ent. Soc. xiii. p. 167.

(145)†Crambus toparius, Zell. Stett. e. Z. 1866, p. 155. U.S.A.

(146)†Crambus ruricolellus, Zell. Mon. Chil. & Cramb. p. 40. U.S.A.

(147) Crambus vulgivagellus, Clem. Proc. A. N. S. Phil. 1860, p. 203. U.S.A.; Vancouver.
† ,, *chalybirostris*, Zell. Mon. Chil. & Cramb. p. 40.
† ,, *aurifimbrialis*, Wlk. xxvii. 157.

(148)†Crambus attenuatus, Grote, Can. Ent. xi. p.18. W.States; Vancouver.

(149) Crambus culmellus, Linn. Europe.

(150) Crambus dumetellus, Hübn. Europe.

(151) Crambus palustrellus, Rag. Bull. Soc. Ent. Fr. (5) vi. p. 78. Europe.

(152) Crambus pratellus, Linn. Europe.

(153)†Crambus oregonicus, Grote, Can. Ent. xi. p. 17. U.S.A.

(154) Crambus alienellus, Zinck. Europe.

(155)†Crambus dissectus, Grote, Can. Ent. xii. p. 16. U.S.A.

(156) Crambus hemigiellus, H.-S. Europe.

(157) Crambus silvellus, Hübn. Europe.

(158) Crambus ericellus, Hübn. Europe.

Type. (159) Crambus pascuellus, Linn. Europe.

(160)†Crambus uliginosellus, Zell. Europe.

(161) Crambus hamellus, Thnb. Europe.

(162)†Crambus nolkeniellus, Zell. S. e. Z. 1872, p. 470, pl. 2. f. 4. Colombia; Bogota.

(163) Crambus candiellus, H.-S. Armenia.

(164) Crambus malacellus, Dup. Palæarctic, Æthiopian,
† ,, *hapaliscus*, Zell. Lep. Caffr. p. 7. Oriental, and
† ,, *concinellus*, Wlk. xxvii. 165. Australian regions.

(165)†Crambus quinquearealis, Zell. Ex. Micr. 38, pl. i. f. 16. U.S.A.

(166)†CRAMBUS LEUCONOTUS, Zell. Hor. Ent. Ross. xvi. p. 167, pl. xi. f. 7. U.S.A.

(167) CRAMBUS PRÆFECTELLUS, Zinck. Germ. Mag. iv. p. 249. U.S.A.
„ *involutellus*, Clem. Proc. A. N. S. Phil. 1860, p. 203.

(168) CRAMBUS LEACHELLUS, Zinck. Germ. Mag. iv. p. 114. U.S.A.
† „ *pulchellus*, Zell. Mon. Chil. & Cramb. p. 18.
† „ *hastiferellus*, Wlk. xxvii. 155.

(169)†CRAMBUS SUBÆQUALIS, Zell. Hor. Ent. Ross. xiii. p. 37. Brazil; Argentina.

(170)†CRAMBUS ARGYROPHORUS, Butl. Ill. Het. ii. p. 61, pl. 40. f. 5. Japan; Sikhim.

(171)*CRAMBUS ORNATELLUS, Leech, Entom. xxii. p. 108, pl. v. f. 2. Japan.

(172)*CRAMBUS ARGENTARIUS, Staud. Siberia.

(173) CRAMBUS NIVELLUS, Koll. Hüg. Kasch. iv. p. 495. Himalayas; Nilgiris.
† „ *todarius*, Butl. P. Z. S. 1883, p. 173.
„ *aurivittatus*, Moore, Lep. Atk. p. 226.

(174)†CRAMBUS FLORIDUS, Zell. Beitr. i. 91. U.S.A.

(175) CRAMBUS CARPENTERELLUS, Pack. Hayden's U.S. Survey, 1873, p. 548. Western States.
† „ *occidentalis*, Grote, Can. Ent. xii. p. 16.

(176) CRAMBUS SATRAPELLUS, Zinck. Germ. Mg. iv. p. 247. U.S.A.
† „ *aculiellus*, Wlk. xxvii. 158.
† „ *elegantellus*, Wlk. xxvii. 179.

(177)†CRAMBUS BIDENS, Zell. Beitr. i. 89. U.S.A.

(178) CRAMBUS AGITATELLUS, Clem. Proc. A. N. S. Phil. 1860, p. 203. U.S.A.
„ *alboclavellus*, Zell. Mon. Chil. & Cramb. p. 19.

(179)†CRAMBUS SALTUELLUS, Zell. Mon. Chil. & Cramb. p. 22. U.S.A.

(180) CRAMBUS LAQUEATELLUS, Clem. Proc. A. N. S. Phil. 1860, p. 203. U.S.A.
† „ *semifusellus*, Wlk. xxvii. 159.

(181)†CRAMBUS YOKOHAMÆ, Butl. A. M. N. H. (5) iv. p. 456. Amur; Jpan.
„ *splendidellus*, Christ. Bull. Mosc. lvi. p. 43.

(182) CRAMBUS ALBELLUS, Clem. P. A. N. S. Phil. 1860, p. 204. U.S.A.

(183)†CRAMBUS BIPUNCTELLUS, Zell. Mon. Chil. & Cramb. p. 23.
U.S.A.

†*Arequipa turbatella*, Wlk. xxvii. 196.

(184) CRAMBUS PORCELLANELLUS, Motsch. Et. Ent. ix. p. 38.
Japan.

† „ *vigens*, Butl. A. M. N. H. (5) iv. p. 456.
„ *fucatellus*, Christ. Bull. Mosc. lvi. p. 45.

(185)*CRAMBUS MANDSCHURICUS, Christ. Bull. Mosc. lvi. p. 44.
Amur.

(186)*CRAMBUS DISTINCTELLUS, Leech, Entom. xxii. p. 107, pl. v. f. 1.
Japan.

(187)*CRAMBUS PURELLUS, Leech, Entom. xxii. p. 107, pl. v. f. 10.
Japan.

(188) CRAMBUS LATELLUS, Snell. Trans. Ent. Soc. 1890, p. 644.
Japan; Himalayas; Assam.

(189)†CRAMBUS MELANOSTICTA, n. sp.

Differs from *latellus* in the palpi being white at tips. Fore wing with two oblique medial costal brown strigæ continued as a single medial line angled below costa, and with a black spot on it at vein 2; the submarginal line brown, further from the margin, double from the costa to its angle at vein 6 and incurved at vein 2; no orange on marginal area; a slight brown marginal line; the cilia silvery.

Hab. Nágas (*Doherty*); Ceylon (*Green*). *Exp.* 16–20 mm.

(190)*CRAMBUS NIGRIPUNCTELLUS, Leech, Entom. xxii. p. 107, pl. v. f. 10.
Corea.

(191)†CRAMBUS CHRYSOPERELLUS, Hmpsn. A. M. N. H. (6) xvi. p. 349.
Grenada; St. Vincent.

(192) CRAMBUS OCULALIS, Snell. Tijd. Ent. xxxvi. p. 64, pl. 3. f. 6.
Ceylon, Java.

(193)†CRAMBUS ARGENTICILIA, n. sp.

♂. Pure silvery white; palpi tinged with fulvous at base. Fore wing with five pale fuscous, slightly sinuous, erect, medial lines; a similar submarginal line slightly excurved between veins 6 and 3; a black marginal line; cilia silvery.

Hab. Bhután (*Dudgeon*); Ceylon (*Green*). *Exp.* 16 mm.

(194)†CRAMBUS AURICINCTALIS, Wlk. xxvii. 183. W. Africa.

(195)†CRAMBUS FLAVIPEDELLUS, Zell. Lep. Caffr. p. 73. S. Africa.

(196)†CRAMBUS AURIFIMBRIELLUS, n. sp.

♂. Silvery white; palpi fulvous at sides; legs pale fulvous. Fore wing with a blackish postmedial speck in interno-median interspace, with a slight ridge of white scales from it becoming golden near the margin; a series of black striæ on the margin; the cilia pale fuscous. Underside of fore wing slightly suffused with fuscous.

Hab. Haiphong, Tonkin (*Buckland*). *Exp.* 18 mm.

(197) CRAMBUS GIRARDELLUS, Clem. P. A. N. S. Phil. 1860, p. 204. U.S.A.
† „ *niveihumellus*, Wlk. xxvii. 159.

(198) CRAMBUS NIGROCILIELLUS, Zell. Mon. Chil. & Cramb. p. 52. Bombay; Siberia; China; Japan; N.W. Himalayas.
† „ *inclaralis*, Wlk. xxvii. 166.
† „ *brachypterellus*, Wlk. xxxv. 1757.
„ *immaturellus*, Christ. Bull. Mosc. lvi. p. 48.

(199) CRAMBUS NIGRICOSTA, Hmpsn. Ill. Het. viii. p. 143, pl. 156. f. 22. Nilgiris.

(200) CRAMBUS INORNATELLUS, Clem. Proc. Ent. Soc. Phil. ii. 418. U.S.A.
† „ *sericinellus*, Zell. Mon. Chil. & Cramb. p. 49.
† „ *innotatellus*, Wlk. xxvii. 156.

(201)†CRAMBUS IMPURELLUS, n. sp.

♂. White, with a slight yellowish tinge and fuscous suffusion; underside of fore wing and the costal area of hind wing suffused with fuscous.

Hab. Gulmurg, Afghanistan (*Fortescue*). *Exp.* 24 mm.

*b*². Palpi hardly reaching beyond the frons, which is produced and conical.

(202)†CRAMBUS SERICINA, Zell. Exot. Micr. p. 70. Colombia.

*b*¹. Fore wing with veins 4, 5 on a long stalk.

(203)†CRAMBUS DISTICTELLUS, n. sp.

Pale brown. Fore wing with the veins slightly delineated by fuscous lines; a black discocellular spot, with another spot below it on vein 2; a black speck at outer angle; two fine brown lines just inside the margin, and a blackish marginal line. Hind wing yellowish white, the apical area slightly suffused with brown, especially in male.

Hab. Brazil (*Schaus*). *Exp.* ♂ 24, ♀ 32 mm.

b. Fore wing with vein 11 anastomosing with 12; hind wing with veins 4, 5 stalked.

(204)†CRAMBUS SIMPLEX, Butl. P. Z. S. 1877, p. 400, pl. 43. f. 12. New Zealand.

(205)†CRAMBUS OCHRISTRIGELLUS, n. sp.

Ochreous. Fore wing with the interspaces irrorated with fuscous scales, forming obscure streaks from base to beyond middle, and obscure postmedial and submarginal series of short streaks; two dark specks on the margin below middle; veins 4, 5 often stalked. Hind wing ochreous white.

Hab. Lahore (*Harford*); Ceylon (*Pole*). *Exp.* 14–22 mm.

(206)†CRAMBUS DELINEATELLUS, n. sp.

♂. Ochreous white; palpi at sides and patagia brown. Fore wing ochreous white; the veins pure white, with fine brown lines on each side of them; fine brown streaks in cell and interspaces below it; a black discocellular spot, a spot below origin of vein 2, and a spot at outer angle; two fine brown lines just inside the margin, and a series of black specks on the margin. Hind wing white.

Hab. Castro Paraña, Brazil (*Jones*). *Exp.* 22 mm.

B. Fore wing with vein 7 given off nearer the apex than 9.

(207)†CRAMBUS MULTIRADIELLUS, n. sp.

Head and thorax black-brown; palpi below, the sides of frons, antennæ, and metathorax white; abdomen greyish. Fore wing black-brown; a white fascia from base bifurcating at middle of cell, again dividing into three branches towards costa and three beyond lower angle of cell; a broad white fascia on inner area irrorated with black; a double fulvous line from costa beyond middle, oblique to below apex, then submarginal; a marginal series of black spots; the cilia silvery. Hind wing pure white.

Hab. São Paulo; Castro Paraña, Brazil (*Jones*). *Exp.* 26 mm.

(208)†CRAMBUS ARGENTILINEELLUS, n. sp.

Head and thorax pale rufous; the patagia tinged with purple; abdomen pale, in some specimens with paired dark lateral patches. Fore wing pale ochreous brown, with broad whitish costal fascia with purple-brown stripe below it; a purple-brown streak below median nervure; pale streaks on the veins beyond the cell; the marginal area orange, with curved silvery submarginal line; a marginal series of black specks; the cilia silvery. Hind wing white with pale fuscous suffusion, chiefly on apical area.

Hab. São Paulo; Castro Paraña, Brazil (*Jones*). *Exp.* 28–32 mm.

List of undetermined Species.

Crambus	*argillaceus*, Pack. Pr. Bost. Soc. N. H. xi. 54.	Labrador.
„	*colchicellus*, Led.	Armenia.
„	*lævigatellus*, Led.	Armenia.
„	*inconspicuellus*, Snell. Tijds. Ent. (2) vii. p. 102, pl. 8. f. 5.	Guinea.
Calamotropha	*robustella*, Snell. Tijds. Ent. (2) vii. p. 100, pl. 8. ff. 2, 3.	Guinea.
„	*abjectella*, Snell. Tijds. Ent. (2) vii. p. 101, pl. 8. f. 4.	Guinea.

Crambus heliocaustus, Wallengr. Œfv. Ak. Förh. xxii. 1, p. 126.
S. Africa.
,, *recalvus*, Wallengr. Œfv. Ak. Förh. xxii. 1, p. 126.
S. Africa.
,, *stilatus*, Zell. Hor. Ent. Ross. xiii. p. 38, pl. i. f. 15.
Argentina.
,, *humidellus*, Zell. Hor. Ent. Ross. xiii. p. 42. Japan.
,, *atrosignatus*, Zell. Hor. Ent. Ross. xiii. p. 43, pl. i. f. 17.
Japan.
,, *caucasicus*, Alph. Troudy. Ent. Ross. x. p. 27. Caucasus.
,, *leuconotus*, Zell. Hor. Ent. Ross. xvi. p. 167, pl. xi. f. 7.
Colombia.
,, *æthonellus*, Meyr. N. Z. Jn. Sci. i. p. 187. New Zealand.
,, *callirhous*, Meyr. N. Z. Jn. Sci. i. p. 187. New Zealand.
,, *siriellus*, Meyr. N. Z. Jn. Sci. i. p. 187. New Zealand.
,, *dimidiatellus*, Grote, Tr. Kansas Ac. viii. p. 57. U.S.A.
,, *graphellus*, Cons. Ann. Soc. Fr. (6) iv. p. 207, pl. ix. f. 5.
Gulf of Juan.
,, *ephorus*, Meyr. Trans. N. Z. Inst. xvii. p. 135.
New Zealand.
,, *diplorrhous*, Meyr. Trans. N. Z. Inst. xvii. p. 136.
New Zealand.
,, *paraxenus*, Meyr. Trans. N. Z. Inst. xvii. p. 137.
New Zealand.
,, *sophronellus*, Meyr. Trans. N. Z. Inst. xvii. p. 138.
New Zealand.
,, *oncolobus*, Meyr. Trans. N. Z. Inst. xvii. p. 138.
New Zealand.
,, *zeellus*, Fernald, Can. Ent. xvii. p. 55=*refotalis*, Hulst.
Tr. Am. Ent. Soc. xiii. p. 166. U.S.A.
,, *hulstellus*, Fernald, Can. Ent. xvii. p. 56. U.S.A.
,, *biradiellus*, Mab. Bull. Soc. Philom. (7) ix. p. 70.
Magellan.
,, *concolorellus*, Christ. Rom. Mem. ii. p. 149, pl. viii. f. 15.
Transcaucasia.
,, *terrestellus*, Christ. Rom. Mem. ii. p. 151, pl. viii. f. 2.
Transcaucasia.
,, *extorralis*, Hulst, Tr. Am. Ent. Soc. xiii. p. 165. U.S.A.
,, *trichusalis*, Hulst, Tr. Am. Ent. Soc. xiii. p. 165. U.S.A.
,, *cypridalis*, Hulst, Tr. Am. Ent. Soc. xiii. p. 165. U.S.A.
,, *delectalis*, Hulst, Tr. Am. Ent. Soc. xiii. p. 165. U.S.A.
,, *offectalis*, Hulst, Tr. Am. Ent. Soc. xiii. p. 166. U.S.A.
,, *cuneolalis*, Hulst, Tr. Am. Ent. Soc. xiii. p. 166. U.S.A.
,, *biothanatalis*, Hulst, Tr. Am. Ent. Soc. xiii. p. 166. U.S.A.
,, *gausapalis*, Hulst, Tr. Am. Ent. Soc. xiii. p. 167. U.S.A.
,, *comptulatalis*, Hulst, Tr. Am. Ent. Soc. xiii. p. 167. U.S.A.
,, *cyrenaicellus*, Rag. Bull. Soc. Ent. Fr. (6) vii. p. 138. Tunis.
,, *profluxellus*, Rom. Mem. iii. p. 45, pl. ii. f. 13.
Transcaucasus.
,, *bolterellus*, Fern. Ent. Am. iii. p. 37. Texas.

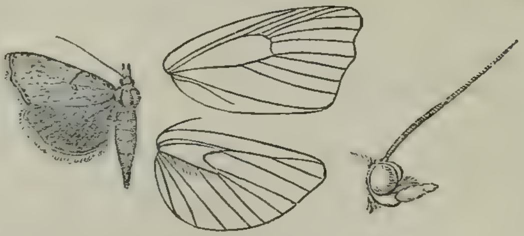
Crambus multilinellus, Fern. Ent. Am. iii. p. 37. Florida.
„ *behrensellus*, Fern. Ent. Am. iii. p. 37. California.
„ *divisellus*, Johannis, Ann. Soc. Ent. Fr. (6) viii. p. 273, pl. vi. f. 4. Beyrout.
„ *vallicolellus*, Casto, Atti Ac. Napoli, (2) i. no. 9, p. 60. Sardinia.
„ *argentistrigellus*, Rag. Ann. Soc. Ent. Fr. (6) viii. p. 279, pl. vi. f. 9. Algeria.
„ *isochytus*, Meyr. Tr. N. Z. Inst. xx. p. 68. New Zealand.
„ *detomatellus*, Möschl. Abh. Senck. Ges. xvi. p. 322. Porto Rico.
„ *descludellus*, Möschl. Abh. Senck. Ges. xvi. p. 323. Porto Rico.
„ *gestatellus*, Möschl. Abh. Senck. Ges. xvi. p. 323. Porto Rico.
„ *psychellus*, Maassen in Stübel's Reise, p. 171, pl. ix. f. 24. Equador.
„ *angustatellus*, Maassen in Stübel's Reise, p. 171, pl. ix. f. 28. Bolivia.
Propexus magnificus, Fern. Can. Ent. xxiii. p. 30. Texas.
Crambus biformellus, Rebel. Stett. e. Z. liv. p. 37. Transcaucasia.
„ *ciliciellus*, Rebel. Stett. e. Z. liv. p. 39. Armenia.
„ *albilinellus*, Fern. Can. Ent. xxv. p. 94. California.
„ *coloradellus*, Fern. Can. Ent. xxv. p. 95. Colorado.
Calamotropha argenteociliella, Pag. Jahrb. Hamb. Anst. x. p. 286. E. Africa.
„ *fuscicostella*, Snell. Tijd. Ent. xxiii. p. 247. Celebes.
Crambus orientellus, H.-S. Europe.
„ *kindermanni*, Zell. Mon. Chil. & Cramb. p. 37. Siberia.
„ *italellus*, Cast. Europe.
„ *siculellus*, Dup. Europe.
„ *æniociliellus*, Ev. Europe.
„ *monotæniellus*, H.-S. Europe.
„ *vectifer*, Zell. Europe.
„ *delicatellus*, Zell. Europe.
„ *staudingeri*, Zell. Europe.
„ *permutatellus*, H.-S. Europe.
„ *nemorellus*, Hübn. Europe.

Genus DIPTYCHOPHORA.

Diptychophora, Zell. Stett. ent. Zeit. 1866, p. 153.
Ditomoptera, Hmpsn. Ill. Het. ix. p. 179 (1893).

Palpi porrect, clothed with long hair and extending about the length of head; maxillary palpi triangularly scaled; proboscis well-developed; frons rounded; antennæ of male somewhat thickened and flattened; tibiæ with the spurs long and equal. Fore wing with the outer margin deeply excised below apex and slightly at vein 5; vein 3 from near angle of cell; 4, 5 from angle; 7 straight and well separated from 8, 9; 10 free; 11 free or becoming coincident with 12. Hind wing with veins 3, 4 from angle of cell, rarely absent; 5 from well above angle; 6, 7 from upper angle.

Fig. 29.



Diptychophora lepidella, ♂. $\frac{3}{2}$.

SECT I. Hind wing with vein 3 present in both sexes.

(1)†DIPTYCHOPHORA LEPIDELLA, Wlk. xxxv. 1761. New Zealand.
Crambus gracilis, Feld. Reis. Nov. pl. 127. f. 26.

(2)*DIPTYCHOPHORA INTERRUPTA, Feld. Reis. Nov. pl. 135. f. 15.
„ *atrosema*, Meyr. N. Z. Journ. Sci. i. 186.
New Zealand.

(3)*DIPTYCHOPHORA HOLANTHOS, Meyr. Tr. N. Z. Inst. xvii. 131.
New Zealand.

(4)†DIPTYCHOPHORA AURISCRIPTELLA, Wlk. xxx. 976.
New Zealand.

(5)†DIPTYCHOPHORA METALLIFERA, Butl. P. Z. S. 1877, p. 401, pl. 43. f. 11. New Zealand.

(6)†DIPTYCHOPHORA BIPUNCTELLA, Wlk. xxxv. 1761. New Zealand.

(7) DIPTYCHOPHORA PYRSOPHANES, Meyr. N. Zeal. Journ. Sci. i. p. 186. New Zealand.

(8)*DIPTYCHOPHORA CHRYSOCLYTA, Meyr. Trans. N. Z. Inst. 1882, p. 12. New Zealand.

(9) DIPTYCHOPHORA SELENÆA, Meyr. Tr. N. Z. Inst. xvii. 131.
New Zealand.

(10) DIPTYCHOPHORA ELAINA, Meyr. N. Z. Journ. Sci. i. 187.
New Zealand.

(11)*DIPTYCHOPHORA EPIPHÆA, Meyr. Tr. N. Z. Inst. xvii. 132.
New Zealand.

(12) DIPTYCHOPHORA ADSPERSELLA, Snell. Tijd. v. Ent. xxxvi. p. 61, pl. 3. f. 4. N.W. Himalayas; Ceylon.

(13) DIPTYCHOPHORA TRIPUNCTATA, Moore, Lep. Atk. p. 226.
Sikhim.

(14)†DIPTYCHOPHORA MINUTELLA, Hmpsn. Ill. Het. ix. p. 179, pl. 174. f. 31. Sikhim; Ceylon.

(15)†Diptychophora griseolalis, n. sp.

♀. Whitish, thickly irrorated with brown. Fore wing with the costa pale fulvous at middle; an antemedial white line with dark line on its outer edge and angled below costa; a slight yellowish discocellular spot; a postmedial line highly excurved below costa, then oblique, crenulate, and with white spots on its outer edge to inner margin; the apical area yellow with a white fascia; a dark line through the cilia.

Hab. Jubbulpore, Bengal. *Exp.* 14 mm.

(16)†Diptychophora parvalis, Wlk. xxxiv. 1316. Brazil.

(17)*Diptychophora azanalis, Wlk. xix. 967. Brazil.

Type. (18)*Diptychophora kuhlweinii, Zell. Stett. ent. Zeit. 1866, p. 154, pl. i. f. 13. Brazil.

Sect. II. Hind wing with vein 3 present in ♂, absent in ♀.

(19)†Diptychophora ochracealis, Wlk. xxxv. 1338. Australia.
,, *præmaturella*, Meyr. P. L. Soc. N. S. W. 1878, p. 198.

Sect. III. Hind wing with vein 3 absent in both sexes.

(20) Diptychophora dilatella, Meyr. P. L. Soc. N. S. W. 1878, p. 199. Australia.

List of undetermined Species.

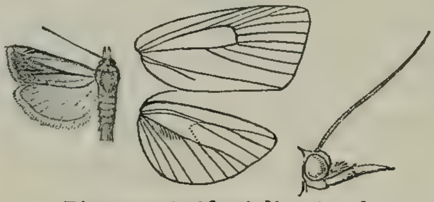
Diptychophora straminiella, Zell. Hor. Ent. Ross. xiii. 32, pl. i. f. 12. New Friburg.
,, *octavianella*, Zell. Hor. Ent. Ross. xiii. 33, pl. i. f. 13. Chiriqui.
,, *leucoxantha*, Meyr. N. Z. Journ. Sci. i. p. 186. New Zealand.
,, *helioctypa*, Meyr. N. Z. Journ. Sci. i. p. 187. New Zealand.
,, *harmonica*, Meyr. Tr. N. Z. Inst. xx. p. 71. New Zealand.
,, *exsectella*, Christ, Bull. Mosc. lvi. p. 41. Amur.

Genus Platytes.

Platytes, Guen. Ind. Meth. p. 86 (1845).
Argyria, Hübn. Verz. p. 372 (? 1818), non descr.
Catharylla, Zell. Mon. Chil. & Cramb. p. 50 (1863).
Urola, Wlk. xxvii. 181 (1863).
Ptychopseustis, Meyr. Trans. Ent. Soc. 1889, p. 521.

Palpi porrect, downcurved at extremity, reaching well beyond the frons and clothed with hair; maxillary palpi triangularly scaled; proboscis well developed; frons rounded; antennæ of male thickened and flattened. Fore wing with vein 3 from before angle of cell; 4, 5 from angle; 6 from well below upper angle; 7 from angle; 8, 9 stalked; 10 and 11 free and oblique. Hind wing with vein 3 from before angle of cell; 4, 5 from angle; 6, 7 from upper angle.

Fig. 30.



Platytes niveifascialis, ♂. $\frac{1}{1}$.

Sect. I. (*Argyria*). Palpi extending about 1½ times length of head.

(1) Platytes nivalis, Drury, ii. pl. xiv. f. 4. U.S.A.; Honduras.
Geometra argentata, Emmons, Nat. Hist. New York, v. pl. 40. f. 2.
†*Catharylla nummulalis*, Zell. Mon. Chil. & Cramb. p. 51.
†*Urola microchrysella*, Wlk. xxvii. 181.

(2) Platytes nummulalis, Hübn. Exot. ff. 185, 186. U.S.A.
†*Catharylla fuscipes*, Zell. Mon. Chil. & Cramb. p. 51.
†*Urola subœnescens*, Wlk. xxvii. 182.

(3)†Platytes tenella, Zell. Mon. Chil. & Cramb. p. 50. Brazil.

(4)†Platytes lucidella, Zell. Mon. Chil. & Cramb. p. 52. Brazil.

(5)†Platytes rufisignella, Zell. Grote's Check List, p. 56. U.S.A.

(6)†Platytes opposita, Zell. Hor. Ent. Ross. xiii. p. 64. Centr. & S. America.
Argyria insons, Feld. Reis. Nov. pl. 137. f. 21.

(7) Platytes pusillalis, Hübn. Zutr. 167, 168. U.S.A.; W.
Zebronia abronalis, Wlk. xix. 967. Indies; Centr. &
†*Catharylla lusella*, Zell. Mon. Chil. & Cramb. p. 51. S. America.
†*Argyria vestalis*, Butl. P. Z. S. 1878, p. 494.

(8)†Platytes pustulella, Wlk. xxxv. 1764. Venezuela.

(9)†Platytes divisella, Wlk. xxxv. 1765. Centr. & S. America.
†*Argyria pontiella*, Zell. Hor. Ent. Ross. xiii. p. 61, pl. i. f. 24.

(10)†Platytes croceivitella, Wlk. xxvii. 182. Brazil.

(11)†Platytes simplex, Zell. Hor. Ent. Ross. xiii. p. 70. Centr. America.

(12) Platytes furvicornis, Zell. Hor. Ent. Ross. xiii. p. 68. Brazil.

SECT. II. (*Platytes*). Palpi extending more than twice the length of head.

A. Fore wing with the apex slightly produced.

a. Fore wing with the outer margin not indented.

(13)†PLATYTES CROCEICINCTELLA, Wlk. xxvii. 182. Venezuela.

(14) PLATYTES AURATELLA, Clem. Proc. A. N. S. Phil. 1860, p. 204.
†*Urola pulchella*, Wlk. xxvii. 183. U.S.A.

(15)†PLATYTES INTERRUPTELLA, Wlk. xxxv. 1763.
Japan; China; Penang.
†*Argyria inficitella*, Wlk. xxxv. 1764.
,, *obliquella*, Zell. Hor. Ent. Ross. xiii. p. 68, pl. i. f. 22.
† ,, *candida*, Butl. Trans. Ent. Soc. 1881, p. 590.

(16)†PLATYTES MARGINEPUNCTALIS, n. sp.

Pure white; palpi rufous at sides; collar with two rufous lines. Fore wing with slight rufous streaks from base along costa, median nervure, and vein 1; a medial rufous line very highly angled below costa, and with a black discocellular spot on it; a double submarginal rufous line highly angled on vein 6, its outer portion indistinct and minutely crenulate near the angle; a marginal series of black specks; the cilia silvery at base, the tips fuscous. Hind wing pure white. Underside of fore wing suffused with fuscous.
Hab. Dharmsála, Punjab (*Hocking*). *Exp.* 18 mm.

(17)†PLATYTES PARALELLUS, Zell. Stett. e. Z. 1867, p. 389, pl. 2. f. 1. Sikhim; Khásis.

(18)†PLATYTES NIVEIFASCIALIS, n. sp.

♂. Head white; palpi brown at sides; thorax white and brown; abdomen ochreous white. Fore wing pale ochreous brown, with silvery-white fascia from base through the cell, terminating in a point beyond the cell and edged by brown lines; some dark brown scales on inner area; a brown line from costa beyond middle, double to vein 6, where it is highly angled near the margin, then inwardly oblique, sinuous and obsolescent; a fuscous triangular shade on outer area meeting the apex of the silvery fascia; a fine dark crenulate marginal line. Hind wing ochreous white, slightly tinged with fuscous on marginal area.
Hab. Nilgiris, S. India (*Hampson*). *Exp.* 22 mm.

(19)†PLATYTES INTERSTRIATELLUS, n. sp.

♂. White; palpi rufous at sides; the thorax marked with rufous; abdomen brownish. Fore wing with the interspaces suffused with rufous; the veins white; a blackish patch below base of cell and a streak on base of inner margin; an ill-defined very oblique white band from lower angle of cell to inner margin, with blackish patches beyond discocellulars and below cell; an oblique submarginal white line from vein 3 to inner margin; a series of blackish submarginal marks. Hind wing whitish.

Hab. Dharmsála, Punjab (*Hocking*). *Exp.* 24 mm.

(20)†Platytes strigulalis, n. sp.

♂. White; palpi fuscous at sides; abdomen with the two basal segments yellow above. Fore wing with oblique yellow-brown strigæ from costa; slight brown streaks below costa and in cell; the inner area irrorated with a few brown scales and with traces of a medial oblique line; a dark discocellular speck; the outer area prominently streaked with yellow-brown; an indistinct waved submarginal line bent inwards to costa and inner margin; a marginal series of black specks. Hind wing white.

Hab. Murree; Mean Meer, Punjab (*Harford*); Nágas, Assam (*Doherty*); Ceylon (*Green*). *Exp.* 20 mm.

(21)†Platytes albipennella, n. sp.

♂. Cretaceous white; palpi brownish at sides; abdomen with the two basal segments ochreous above. Fore wing with traces of pale fulvous streaks in the interspaces and of a pale fulvous spot at lower angle of cell; a marginal series of dark specks; cilia with three brown lines through them. Hind wing pure white.

Hab. Murree, Punjab (*Harford*). *Exp.* 18 mm.

(22) Platytes squamulella, Zell. Hor. Ent. Ross. 1881, p. 158, pl. xi. f. 3. U.S.A.

(23) Platytes densella, Zell. Hor. Ent. Ross. 1881, p. 158, pl. xi. f. 2. U.S.A.

(24) Platytes interlineata, Zell. Hor. Ent. Ross. 1881, p. 156, pl. xi. f. 1. Colombia.

(25) Platytes pulverulentella, Zell. S. e. Z. 1870, p. 473, f. 7. Bogotá.

(26) Platytes pallidella, Dup. Europe.

(27)†Platytes polyactinella, n. sp.

Pure white; palpi brown at sides; fore legs brown. Fore wing with very broad brown fascia from base through the cell to outer margin below apex, streaks along medial nervure, the veins beyond the cell, in interno-median interspace and on vein 1; a series of black marginal specks; cilia with brown bases and tips. Hind wing white.

Hab. Castro Paraña, Brazil (*Jones*). *Exp.* 26 mm.

(28)†Platytes sagitella, n. sp.

♂. Head, thorax, and abdomen golden bronze; the patagia and abdomen marked with white. Fore wing golden bronze; a white fascia on costal area not reaching the apex; a white fascia from base below cell to middle of wing, with black on its upper edge, continued as a white streak on vein 1, and emitting an angled white mark to middle of inner margin; a black-edged oblique white band from below apex, sending a sagittate white mark to lower angle of cell, then angled outwards to outer angle; a white marginal band and black marginal line; the cilia white, olive at base. Hind wing pure white, with fine black marginal line.

Hab. São Paulo; Castro Paraña, Brazil (*Jones*). *Exp.* 26 mm.

(29)†Platytes endochalybella, n. sp.

♂. Head and collar brown; thorax and abdomen golden bronze. Fore wing dark vinous brown; the inner area golden bronze, with two small brown and white lunules at middle; a pale white-edged somewhat triangular mark beyond lower angle of cell; a white marginal band with dentate inner edge not reaching inner margin. Hind wing pale; the apical area tinged with fuscous; traces of a waved fuscous submarginal line.

Hab. Castro Paraña, Brazil (*Jones*). *Exp.* 26 mm.

(30)†Platytes pentadactylus, Zell. Mon. Chil. & Cramb. p. 38.
New Zealand; Tasmania.
†*Aquita claviferella*, Wlk. xxxv. 1765.
†*Aphomia strigosa*, Butl. P. Z. S. 1887, p. 398, pl. 43. f. 10.

(31)†Platytes ictericalis, Swinh. P. Z. S. 1885, p. 876, pl. 57. f. 16. Poona.

(32)†Platytes fuscivenalis, n. sp.

Ochreous. Fore wings with the veins streaked with brown; an obsolescent, bisinuate, very oblique leaden-coloured antemedial line; two leaden-coloured discocellular specks; a postmedial leaden-coloured line, very oblique, from costa to vein 6, then waved and obsolescent; a marginal series of dark specks. Hind wing pale ochreous, with dark marginal specks from apex to vein 3.

Hab. Ceylon (*Pole*). *Exp.* 18 mm.

(33)†Platytes plumbeolinealis, n. sp.

Differs from *fuscivenalis* in being uniform ochreous irrorated with fuscous. Fore wing with the ante- and postmedial lines prominently silvery, oblique from costa to above middle, then waved and nearly erect to inner margin. Hind wing with traces of submarginal line.

Some specimens have the fore wing strongly suffused with leaden grey before the antemedial and beyond the postmedial lines.

Hab. Punjab; Ceylon (*Pole*). *Exp.* 18 mm.

Type. (34) Platytes cerusella, Schiff. Europe.

b. Fore wing with the outer margin slightly indented at vein 6.

(35)†PLATYTES ARGENTISPARSALIS, n. sp.

♀. Differs from *plumbeolinealis* in being more fuscous and prominently irrorated with black scales. Fore wing with brilliant silver line from base of costa to median nervure, near angle of cell, then erect to inner margin, with a black spot inside it below the cell; a curved silver fascia on subcostal nervure at end of cell, and a spot at lower angle; the silvery submarginal line more excurved below costa and nearer the margin; the marginal specks more prominent and on a grey band.

Hab. Ceylon (*Pole*). *Exp.* 18 mm.

(36)†PLATYTES KADENII, Zell. Mon. Chil. & Cramb. p. 16. Venezuela.

B. Fore wing with the apex produced to a long point.

(37)†PLATYTES CARACTELLA, Zell. Europe.

(38) PLATYTES ALPINELLA, Hübn. Europe.

List of undetermined Species.

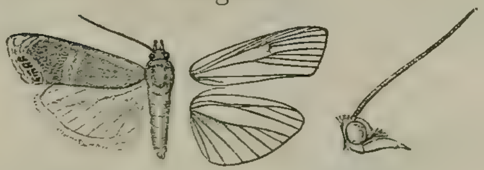
Catharyla interrupta, Zell. Stett. ent. Zeit. 1866, p. 156, pl. i. f. 15. Venezuela.
„ *contiguella*, Zell. Verh. z.-b. Wien, xxxii. p. 540. Texas.
„ *rufisignella*, Zell. Verh. z.-b. Wien, xxii. p. 540. Texas.
Argyria subtilis, Feld. Reis. Nov. pl. 137. f. 22. Bogotá.
„ *mesodonta*, Zell. Hor. Ent. Ross. xiii. p. 62. Chanchamayo.
„ *sordipes*, Zell. Hor. Ent. Ross. xiii. p. 67. Buenos Ayres.
„ *pentaspila*, Zell. Hor. Ent. Ross. xiii. p. 70. New Friburg.
„ *bifasciella*, Snell. Tijd. v. Ent. xxxvi. p. 63, pl. 3. f. 5. Celebes.
Tortrix norwichiana, Hübn. Eur. Schmett. Tort. f. 252. ? America.
Platytes lugdunella, Snell. Europe.

Genus EROMENE.

Eromene, Hübn. Verz. p. 366 (? 1818).
Euchromius, Guen. Ind. Meth. p. 86 (1845), preocc.

Proboscis well developed; palpi porrect, extending about twice the length of head, and thickly scaled; maxillary palpi triangularly scaled; frons produced to a conical process; antennæ of male thickened and flattened; tibiæ with the outer spurs about two thirds length of inner. Fore wing with the apex usually rounded; vein 3 from before angle of cell; 4, 5 well separated at origin; 7 well separated from 8, 9; 10 free; 11 oblique and not approximated to 12; male with a shallow fovea in cell. Hind wing with vein 3 from before angle of cell; 4, 5 from angle; 6, 7 from upper angle.

Fig. 31.



Eromene ocellea, ♂. $\frac{3}{2}$.

(1)†Eromene expansa, Butl. Trans. Ent. Soc. 1881, p. 590. Japan.

Type. (2) Eromene bella, Hübn. Europe.

(3)†Eromene anapiella, Zell. Sicily.

(4)†Eromene wocheella, Zell. Europe.

(5) Eromene ramburiella, Dup. Sicily; Syria.
„ *vinculella*, Zell.

(6)†Eromene superbella, Zell. Europe; Syria; Punjab.

(7)*Eromene cambridgei, Zell. Trans. Ent. Soc. (3) v. p. 463. Egypt.

(8) Eromene ocellea, Haw. Europe; Algeria; Aden; Persia; Punjab; Bombay.

(9) Eromene californicalis, Pack. Ann. Lyc. N. York, x. p. 264. California; Sandwich Isls.

(10) Eromene texana, Rob. Ann. Lyc. Nat. Hist. ix. p. 155, pl. i. f. 5. U.S.A.

(11)*Eromene chiriquitensis, Zell. Hor. Ent. Ross. 1877, p. 70, pl. i. f. 25.

List of undetermined Species.

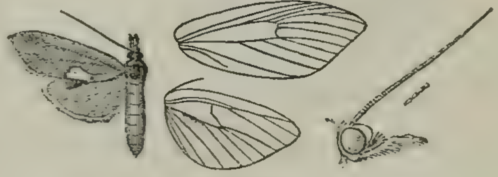
Eromene lata, Staud. Greece.
„ *jaxartella*, Ersch, Lep. Turk. p. 82. Turkestan.
„ *pulverosa*, Rom. Mém. iii. p. 47, pl. ii. f. 14. Transcaucasia.

Genus Canuza.

Canuza, Wlk. xxxv. 1771 (1866).
Erotomanes, Meyr. P. Linn. Soc. N. S. W. vii. p. 152 (1882).

Proboscis well developed; palpi extending about twice the length of head and thickly clothed with long hair; maxillary palpi triangularly scaled; frons with a conical prominence; antennæ somewhat annulate; tibiæ with the spurs long; abdomen with the claspers large. Fore wing with the costa arched towards apex, which is somewhat rounded; vein 3 from before angle of cell; 4, 5 well separated at origin; 7 from upper angle; 10, 11 free and oblique. Hind wing with the median nervure slightly pectinated; veins 1 *b* and *c* more strongly pectinate; vein 3 from before angle of cell; 4, 5 from a point; 6, 7 stalked.

Fig. 32.



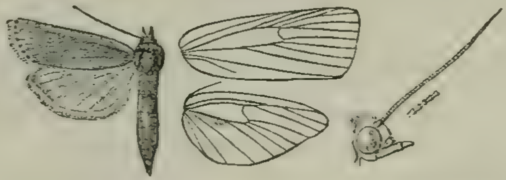
Canuza euspilella, ♂. $\frac{3}{2}$.

Type. (1)†CANUZA EUSPILELLA, Wlk. xxxv. 1771. Australia.
Anerastia mirabilella, Meyr. Proc. Linn. Soc. N. S. W. 1878, p. 213.

Genus STENOCHILO, nov.

Palpi porrect, extending about one and a half times length of head, and smoothly scaled; maxillary palpi dilated with scales at extremity; proboscis absent; frons with a conical prominence; antennæ of female somewhat annulate; tibiæ with the outer spurs about two thirds length of inner. Fore wing long and very narrow; the apex rectangular; the inner margin lobed towards base; vein 3 from near angle of cell; 4, 5 well separated at origin; 6, 7 shortly stalked; 10, 11 free. Hind wing with vein 3 from near angle of cell; 4, 5 from a point; 6, 7 shortly stalked.

Fig. 33.



Stenochilo canicostalis, ♂. $\frac{1}{1}$.

Type. †STENOCHILO CANICOSTALIS, n. sp.

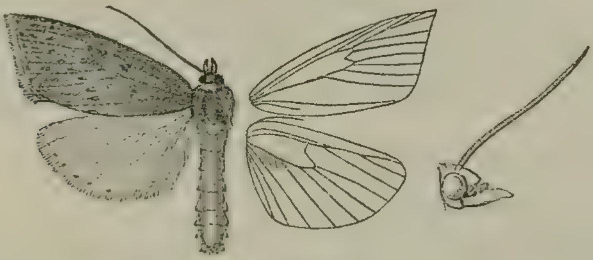
♀. Reddish brown, irrorated with grey; the head, collar, and costal area of fore wing very thickly irrorated; the last with white spot below middle of cell; traces of a submarginal line and marginal series of specks. Hind wing hyaline white.

Hab. Hillaya, Sind. *Exp.* 30 mm.

Genus MACROCHILO, nov.

Palpi porrect, clothed with rough hair, and extending about one and a half times length of head; maxillary palpi dilated with hair; frons with a conical process; antennæ of male thickened by appressed serrations; patagia fringed with long hair in male; tibiæ with the spurs long, the outer spurs about two thirds length of inner. Fore wing with the apex acute and produced; vein 3 from before angle of cell; 4, 5 from angle; 7 shortly stalked, with 8, 9, 10; 11 oblique. Hind wing with vein 3 from before angle of cell; 4, 5 from angle; 6, 7 stalked.

Fig. 34.



Macrochilo ambiguellus, ♂. $\frac{1}{1}$.

Type. MACROCHILO AMBIGUELLUS, Snell. Trans. Ent. Soc. 1890, p. 642, pl. xx. f. 4. Sikhim; Khásis.

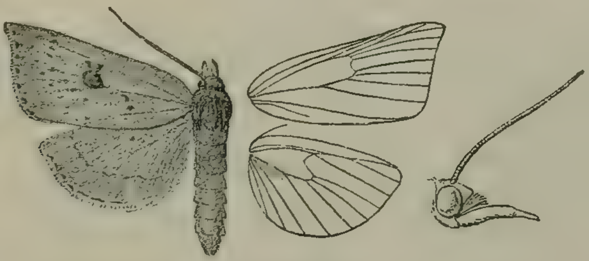
Pydna notata, Swinh. Trans. Ent. Soc. 1891, p. 479, pl. xix. f. 16.

Genus ERUPA.

Erupa, Wlk. xxx. 980 (1864).
Gabalæca, Wlk. xxxv. 1743 (1866).
Zolca, Wlk. xxxv. 1769.

Palpi porrect, extending about three times length of head, and thickly clothed with hair; maxillary palpi triangularly dilated with hair; proboscis absent; frons with a conical projection; antennæ of male thickened and flattened, with appressed serrations. Fore wing with the costa arched at base; the apex somewhat produced; vein 3 from before angle of cell; 4, 5 well separated at origin; 6 from below upper angle; 7 from angle; 8, 9, 10 stalked; 11 oblique. Hind wing with vein 3 from before angle of cell; 4, 5 well separated at origin; 6, 7 from upper angle.

Fig. 35.



Erupa chiloides, ♂. $\frac{1}{1}$.

SECT. I. Both wings with the outer margin evenly curved.

(1)†ERUPA CONGRUELLA, Wlk. xxxv. 1769. Brazil.

Chilo virgatus, Feld. Reis. Nov. pl. 137. f. 3.

(2)†Erupa argentescens, n. sp.

♂. Head and thorax red-brown, suffused with purplish grey; abdomen ochreous white, reddish at base. Fore wing rufous, suffused with silvery purple, except the costal area, and irrorated with a few dark scales; a rufous spot in middle of cell; an oblique rufous line from lower angle of cell to inner margin, with diffused rufous beyond it; a minutely crenulate submarginal line slightly excurved from costa to vein 2. Hind wing whitish, with slightly curved brown submarginal line; the outer area slightly tinged with brown.

Hab. Castro Paraña, Brazil (*Jones*). *Exp.* 38 mm.

(3)†Erupa nigrescentella, n. sp.

Dark fuscous brown; palpi white below at base; abdomen pale brown, the base tinged with fulvous. Wings glossy; fore wing with indistinct discocellular spot; both wings with traces of curved postmedial line.

Hab. Castro Paraña, Brazil (*Jones*). *Exp.* 28–30 mm.

Type. (4)†Erupa chiloides, Wlk. xxx. 980. Brazil.

(5)†Erupa bilineatella, Wlk. xxxv. 1743. Brazil.

(6)†Erupa lactealis, n. sp.

♀. Creamy white; palpi pale rufous at sides. Fore wing with the costal area tinged with rufous; a very oblique sinuous brown line from lower angle of cell to inner margin before middle; an oblique dentate brown submarginal line; the outer area and cilia tinged with rufous; some dark specks on the margin. Hind wing with short oblique brown line from lower angle of cell to below vein 2; a dentate brown submarginal line not reaching the costa or inner margin; some marginal dark specks and the cilia rufous towards apex.

Hab. Rio Janeiro. *Exp.* 36 mm.

(7)†Erupa pinosa[1], Zell. Hor. Ent. Ross. 1881, p. 165, pl. xi. f. 6. Colombia.

(8)†Erupa roseiceps, n. sp.

Head and collar bright pink; thorax, abdomen, and fore wing ochreous, the last irrorated with pinkish brown; traces of a pink fascia below the cell, and of a curved series of spots from its termination to costa; a dark discocellular speck; traces of a curved submarginal series of pinkish-brown spots; a marginal series of black specks. Hind wing yellowish white.

Hab. Castro Paraña, Brazil (*Jones*). *Exp.* 32 mm.

Sect. II. Both wings with the outer margin excurved between veins 4 and 2.

(9)†Erupa ruptilineella, n. sp.

Head and thorax dark rufous; abdomen ochreous. Fore wing dark rufous with a silvery gloss; a short rufous line with white inner edge from costa to subcostal nervures before middle of similar slightly oblique line from middle of cell to inner margin; a rufous discocellular line; a white mark at lower angle of cell; a white-edged, rufous, slightly sinuous, oblique postmedial line. Hind wing ochreous; a discocellular fuscous spot; an oblique fuscous postmedial line, the area beyond it slightly tinged with fuscous.

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[1] Zeller's females are all males of his *Chilo validus*.

Hab. Jalapa, Mexico (*Schaus*). *Exp.* 40 mm.

Undetermined Species.

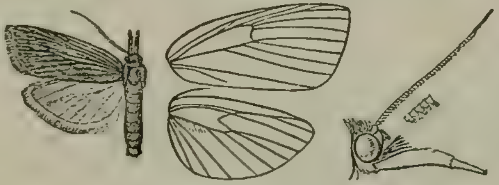
Erupa titanialis, Feld. Reis. Nov. pl. 137. f. 4. Brazil.

Genus Diatræa.

Diatræa, Lands. Guild. Trans. Soc. Encour. Arts, xlvi. 143 (1832).

Palpi extending about three times length of head and thickly clothed with hair; maxillary palpi triangularly dilated with hair; proboscis absent; frons with a tuft of hair; antennæ of male minutely serrate and fasciculate; tibiæ somewhat hairy, the spurs well developed. Fore wing with the apex somewhat acute; vein 3 from before angle of cell; 4, 5 from angle; 6, 7 from near upper angle; 8, 9 stalked; 10 free; 11 anastomosing with 12. Hind wing with vein 3 from before angle of cell; 4, 5 from angle; 6, 7 from upper angle.

Fig. 36.



Diatræa saccharalis, ♂. $\frac{1}{1}$.

Type. (1) Diatræa saccharalis, Fabr. Ent. Syst. iii. 2, 238. S. States;
†*Chilo obliteratellus*, Zell. Mon. Chil. & Cramb. p. 8. W. Indies; Centr. &
†*Crambus leucaniellus*, Wlk. xxvii. 161. S. America.
† „ *lineosellus*, Wlk. xxvii. 162.
Chilo companellus, Feld. Reis. Nov. pl. 137. f. 5.
† „ *crambidoides*, Grote, Can. Ent. xii. p. 15.

(2) †Diatræa lineolata, Wlk. ix. p. 100. Centr. & S. America.
†*Chilo culmicolellus*, Zell. Mon. Chil. & Cramb. p. 7.
† „ *neuricellus*, Zell. Mon. Chil. & Cramb. p. 8.
†*Crambus impersonatellus*, Wlk. xxvii. 163.

(3) †Diatræa mauriciella, Wlk. xxvii. 141. Mauritius.

(4)†DIATRÆA VENOSATA, Wlk. xxvii. 144. Borneo; Java.
„ *striatalis*, Snell. Tijd. Ent. xxxiv. p. 349, pl. xix. ff. 1–4.

(5)†DIATRÆA CANELLA, Hmpsn. A. M. N. H. (6) xvi. p. 349. W. Indies; Brazil.

Undetermined Species.

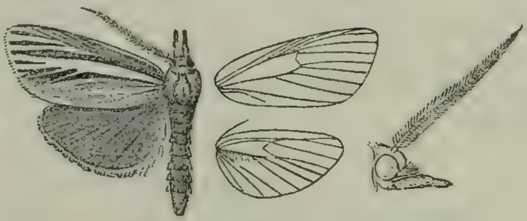
Diatræa differentialis, Fern. Ent. Am. iv. p. 120. U.S.A.

Genus UBIDA.

Ubida, Wlk. xxvii. 185 (1863).
Crunophila, Meyr. P. Linn. Soc. N. S. W. vii. p. 152 (1882).

Proboscis absent; palpi porrect, extending about twice the length of head and thickly clothed with hair; maxillary palpi triangularly scaled; frons rounded; antennæ of male bipectinate with short branches, of female serrate; tibiæ with the spurs long. Fore wing with the apex rounded; vein 3 from before angle of cell; 4, 5 well separated at origin; 7 from upper angle; 10, 11 free and oblique. Hind wing with vein 3 from before angle of cell; 4, 5 from a point; 6, 7 from upper angle.

Fig. 37.



Ubida ramostriella, ♂. 1/1.

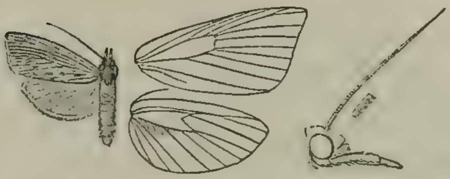
Type. †UBIDA RAMOSTRIELLA, Wlk. xxvii. 172. Australia.
† „ *receptalis*, Wlk. xxvii. 186.
Chilo schistellus, Meyr. P. L. Soc. N. S. W. iv. p. 207.

Genus CHILO.

Chilo, Zinck. Germ. Mag. ii. 36 (1817).
Erpina, Wlk. xxxv. 1707 (1866).
Donacoscaptes, Zell. Hor. Ent. Ross. 1877, p. 16.
Diphrix, Grote, Bull. U.S. Geol. Surv. vi. p. 273 (1881).

Palpi porrect, clothed with rough hair, and extending from two and a half to three times length of head; maxillary palpi dilated with scales at extremity; frons with a conical projection; antennæ minutely serrate and ciliated; tibiæ with the outer spurs about two thirds length of inner. Fore wing with the apex slightly produced in male, more produced in female; vein 3 from before angle of cell; 4, 5 well separated at origin; 7 straight and well separated from 8, 9; 10 free; 11 curved and approximated to 12. Hind wing with vein 3 from near angle of cell; 4, 5 from angle; 6, 7 from upper angle.

Fig. 38.



Chilo simplex, ♂. $\frac{1}{1}$.

SECT. I. Hind wing of male with no fold below subcostal nervure containing a tuft of hair.

A. Fore wing of female with the apex slightly produced.

a. (*Donacoscaptes*). Frons produced to a long sharp point.

(1) CHILO VALIDUS, Zell. Hor. Ent. Ross. 1877, p. 16, pl. i. f. 4 *a*, *b*. Colombia; Amazons.

b. Frons with a much shorter conical prominence.

(2) CHILO DICHROMELLUS, Wlk. xxxv. 1707. *Hab.* unknown.

(3)†CHILO VINOSELLUS, n. sp.

♂. Dark red-brown with a purplish tinge. Fore wing with purplish suffusion in cell and on outer area; a whitish mark at lower angle of cell; a series of whitish submarginal specks; a marginal series of black specks and white specks at base of cilia. Hind wing paler except the outer area.

Hab. British Honduras. *Exp.* 30 mm.

(4)†CHILO INCANELLUS, n. sp.

♂. Grey-brown; vertex of head whitish; palpi and frontal tuft blackish at sides; shoulders blackish; abdomen blackish, with pale rings and dark anal tuft. Fore wing irrorated with a few black scales and with faint traces of oblique postmedial and submarginal lines. Hind wing fuscous; the inner area clothed with blackish hair; both wings with marginal series of black specks. Underside whitish; both wings with indistinct curved submarginal line.

Hab. Castro Paraña, Brazil (*Jones*). *Exp.* 46 mm.

(5)†CHILO NIGRISTIGMELLUS, n. sp.

♀. Pale ochreous; the base of abdomen fulvous; fore wing thickly irrorated with black; a prominent black discocellular spot; an oblique line from beyond upper angle of cell to inner margin before middle; traces of a submarginal line. Hind wing whitish, with blackish hair on inner area; a diffused postmedial line; both wings with the marginal specks prominent; underside with black discocellular spot.

Hab. Castro Paraña, Brazil (*Jones*). *Exp.* ♂ 44, ♀ 60 mm.

(6)†CHILO FUSCIDENTALIS, n. sp.

♀. Reddish brown suffused with fuscous. Fore wing with the costal half fuscous to beyond cell; a reddish-brown spot in end of cell; a dentate dark antemedial line oblique from costa to vein 1; a curved highly dentate dark submarginal line. Hind wing with obscure curved diffused postmedial line terminating at vein 2.

Hab. Sikhim, Bengal (*Dudgeon*). *Exp.* 46 mm.

(7)†CHILO XYLINALIS, n. sp.

♂. Very dark cupreous brown. Fore wing with a black streak irrorated with grey scales in and below end of cell and a similar streak below median nervure. Hind wing dark red-brown.

♀. Pale yellowish brown; abdomen tinged with fuscous, the 3rd segment with a yellowish band. Fore wing slightly irrorated with black scales, forming an obscure streak below median nervure; a few dark scales in end of cell; a spot on discocellulars and another beyond them; two obscure series of submarginal specks; a marginal series of black specks. Hind wing whitish, suffused with pale fuscous brown. Underside whitish.

Hab. Goya, Argentina (*Perrins*). *Exp.* ♂ 30, ♀ 40–50 mm.

(8)†CHILO IGNITALIS, n. sp.

♂. Head and thorax red-brown; abdomen pale. Fore wing red-brown, pale in parts, in others suffused with purple; an indistinct dark subbasal spot below median nervure; an obscure dark antemedial line angled below median nervure; an oblique somewhat maculate medial line and a similar postmedial line angled on vein 5. Hind wing pale yellowish; the apical part of margin tinged with fuscous.

♀ with the head, thorax, and fore wing fiery chestnut.

Hab. São Paulo, Brazil. *Exp.* ♂ 32, ♀ 40 mm.

(9)†CHILO INFUSELLUS, Wlk. xxvii. 140. Surinam; Santarem; Amazons.

(10)†CHILO PURPUREALIS, n. sp.

♂. Yellowish brown suffused with purple; abdomen pale. Fore wing with the inner area in some specimens mostly ochreous; somewhat ill-defined oblique antemedial and medial minutely dentate dark lines from cell to inner margin; a black discocellular spot; a minutely dentate dark submarginal line curved below costa. Hind wing pale yellowish with slight fuscous tinge.

♀. Fiery orange-red; abdomen and hind wing yellowish white; fore wing with the lines indistinct; the cilia dark.

Hab. Goya, Argentina (*Perrins*). *Exp.* ♂ 30, ♀ 42 mm.

(11)†CHILO DEMOTELLUS, Wlk. xxxv. 1749. Japan.

(12) CHILO LUTELLUS, Motsch. Bull. Mosc. xxxix. i. 198. Egypt;
„ *dubia*, Baker, Trans. Ent. Soc. 1894, p. 48, pl. i. f. 18. Japan.

(13)†Chilo obliquilineellus, n. sp.

Dull ochreous; abdomen with a fulvous basal band. Fore wing slightly suffused and irrorated with pale reddish brown; an indistinct brown hue from outer margin at vein 5 running to near origin of vein 2 and minutely dentate on the veins, then strongly dentate below vein 2 and terminating at middle of inner margin; a discocellular spot; traces of a waved submarginal line excurved to near margin at middle; a marginal series of black specks. Hind wing yellowish white.

One specimen has the thorax and base of fore wing much brighter yellow, the area beyond the irregular line almost white.

Hab. Rio Janeiro (*Schaus*). *Exp.* ♂ 44–48, ♀ 54 mm.

(14)†Chilo luniferalis, n. sp.

♀. Ochreous white. Fore wing with traces of a streak of black scales below cell; a black discocellular lunule with a diffused streak of black scales from it to outer margin; a prominent series of marginal black spots. Hind wing pure white, with a few fuscous specks on the margin.

Hab. Abyssinia. *Exp.* 34 mm.

(15)†Chilo simplex, Butl. P. Z. S. 1880, p. 690. Japan; China; Formosa; Punjab; Sind.
†*Crambus zonellus*, Swinh. P. Z. S. 1884, p. 528 pl. 48. f. 16.
† „ *partellus*, Swinh. P. Z. S. 1885, p. 879.

(16)* Chilo gensanellus, Leech, Entom. xxii. p. 108, pl. v. f. 9. Corea; Japan.

(17)†Chilo plejadellus, Zinck. Germ. Mag. iv. p. 251.
†*Crambus sabuliferus*, Wlk. xxvii. 185. U.S.A.
†*Diphrix prolatella*, Grote, U.S. Geol. Surv. vi. p. 273.
Chilo orizæellus, Riley, Rep. Ins. 1882, p. 135, pl. vii. f. 1.

(18)†Chilo ceylonica, n. sp.

Ochreous brown irrorated with fuscous. Fore wing with the fuscous irroration forming streaks in the interspaces except on inner margin; an indistinct fulvous medial line curved below costa and with silvery streaks on its edges; a submarginal silver line bent inwards below costa; a marginal series of black spots with white centres; cilia silvery. Hind wing whitish, tinged with fuscous on apical area in male; an indistinct marginal series of black specks.

Hab. Ceylon (*Pole*). *Exp.* ♂ 22, ♀ 26 mm.

(19)†Chilo suppresalis, Wlk. xxvii. 166. S. Africa; China; India; Ceylon.

(20)†Chilo pulverulentus, Warr. A. M. N. H. (6) ix. p. 393. Punjab; Khásis.

(21) Chilo alleni, Fern. Ent. Am. iv. p. 120. U.S.A.

(22)*CHILO TORRENTELLUS, Meyr. Proc. Linn. Soc. N. S. W. iii. p. 183. Sikhim; Burma; Australia.

(23) CHILO SCISSELLUS, McVind. Brazil; Argentina.

(24) CHILO CICATRELLUS, Hübn. Europe.

(25) CHILO RESPERSALIS, Hübn. Exot. Schmett. ff. 125, 126. Argentina; Chili.
† „ *ceres*, Butl. Trans. Ent. Soc. 1883, p. 61.

B. Fore wing of female with the apex extremely produced and acute.

Type. (26) CHILO PHRAGMITELLUS, Hübn. Europe.

SECT. II. Hind wing of male with a fold below the subcostal nervure containing a tuft of long hair.

(27)†CHILO LATIVITTALIS, Wlk. xxvii. 171.
† „ *halterellus*, Zell. Mon. Chil. & Cramb. p. 33. Australia.

List of undetermined Species.

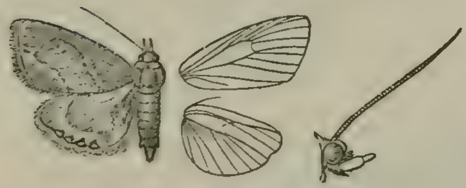
Chilo cinnamomellus, Berg, Bull. Mosc. xlix. pt. 2, p. 227. Patagonia.
„ *prodigealis*, Zell. Hor. Ent. Ross. xiii. 18, pl. i. f. 5. New Friburg.
„ *heracleus*, Zell. Hor. Ent. Ross. xiii. 20, pl. i. f. 6. Brazil.
„ *paramattellus*, Meyr. J. L. Soc. N. S. W. iii. p. 178. Australia.
„ *spatiosellus*, Möschl. Verh. z.-b. Ges. Wien, xxxi. p. 436. Surinam.
„ *surinamellus*, Möschl. Verh. z.-b. Ges. Wien, xxxi. p. 436. Surinam.
„ *irrectellus*, Möschl. Verh. z.-b. Ges. Wien, xxxi. p. 437, pl. xviii. ff. 41–44. Surinam.
„ *centrellus*, Möschl. Verh. z.-b. Ges. Wien, xxxii. 360, pl. xviii. f. 45. Surinam.
„ *infuscatellus*, Snell. Tijds. Ent. xxxiv. 347. Java.

Genus CHALCOËLA.

Chalcoëla, Zell. Verh. zool.-bot. Ges. Wien, 1872, p. 528.

Proboscis absent; palpi porrect, extending about twice the length of head, the 1st joint fringed with long hair below, the 2nd and 3rd nearly naked; maxillary palpi dilated with scales at extremity; frons rounded; antennæ thickened and flattened; tibiæ with the spurs long. Fore wing broad; the apex rounded; vein 3 from near angle of cell; 4, 5 from angle; 7 from upper angle; 10, 11 free. Hind wing with vein 3 from near angle of cell; 4, 5 from angle; 6, 7 from upper angle.

Fig. 39.



Chalcoëla iphitalis, ♂. $\frac{3}{2}$.

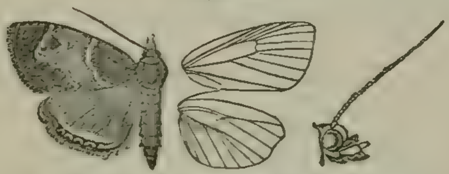
Type. CHALCOËLA IPHITALIS, Wlk. xvii. 444[1]. U.S.A.
† ,, *aurifera*, Zell. Verh. zool.-bot. Ges. Wien, 1872, p. 529, pl. 2. f. 2.

Genus DICYMOLOMIA.

Dicymolomia, Zell. Verh. zool.-bot. Ges. Wien, 1872, p. 530.

Differs from *Chalcoëla* in the palpi extending about the length of head and with tufts of long hair from below both 1st and 2nd joints.

Fig. 40.



Dicymolomia pegasalis, ♂. $\frac{1}{1}$.

Type. (1)†DICYMOLOMIA JULIANALIS, Wlk. xvii. 438. U.S.A.
† ,, *decora*, Zell. Verh. zool.-bot. Ges. Wien, 1872, p. 531, pl. 2. f. 13.

(2) DICYMOLOMIA METALLIFERALIS, Pack. Ann. Lyc. N. Y. x. p. 265. California.
†*Dicymolomia sauberi*, Von Hedemann, Verh. Ver. Hamb. v. Anhang.

(3)†DICYMOLOMIA PEGASALIS, Wlk. xvii. 438. U.S.A.; Jamaica.
†*Cataclysta principalis*, Wlk. xxxiv. 1333.
† ,, *egressalis*, Wlk. xxxiv. 1335.
,, *robinsonii*, Grote, Can. Ent. iii. p. 181.

(4)†DICYMOLOMIA DIMINUTALIS, Warr. A. M. N. H. 1891, ii. p. 65. Callao.

Genus LEUCARGYRA, nov.

Palpi porrect and not reaching nearly to the end of the frons, which is greatly produced to a corneous point; maxillary palpi minute; proboscis rudimentary; antennæ of male minutely serrate; tibiæ with the spurs short. Fore wing with vein 3 from before angle of cell; 4, 5 from angle; 6 from upper angle; 7, 8, 9, 10 stalked; 11 becoming coincident with 12. Hind wing with vein 3 from before angle of cell; 4, 5 well separated at origin; 6, 7 stalked.

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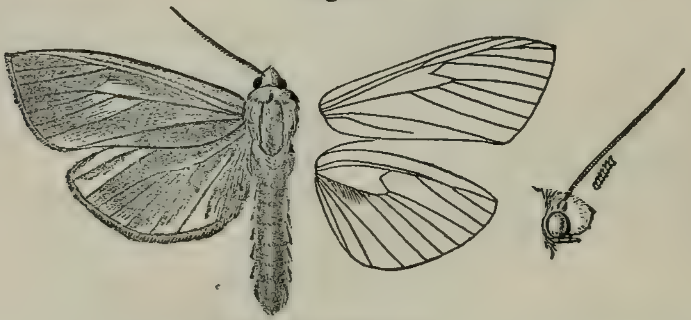
[1] The locality of Walker's type is given as S. Africa, but the specimen was purchased from a dealer and the locality is almost certainly wrong.

Fig. 41.



Leucargyra puralis, ♂. 1/1.

Type. †LEUCARGYRA PURALIS, n. sp.

♂. Silvery white; palpi black at sides; fore legs black above. The larva feeds in the interior of grasses.

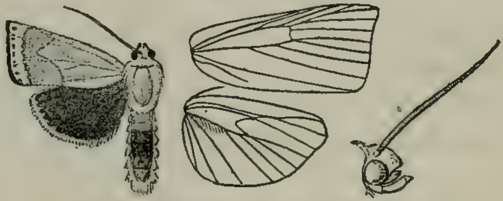
Hab. Theresopolis, Brazil. *Exp.* 60 mm.

Genus ESCHATA.

Eschata, Wlk. ix. p. 133 (1856).
Chærecla, Wlk. xxxii. p. 633 (1865).

Proboscis rudimentary. Palpi porrect, reaching slightly beyond the frons and thickly scaled; maxillary palpi dilated with scales and nearly as long as the labial; frons produced to an acute corneous point; antennæ of male thickened and flattened; tibiæ and tarsal joints fringed with long hair. Fore wing with vein 3 from before angle of cell; 7 from cell, anastomosing, or rarely shortly stalked with 8, 9; 10 free; 11 curved and running along 12. Hind wing with veins 3, 4, 5 from angle of cell; 6, 7 from upper angle.

Fig. 42.



Eschata xanthorhyncha, ♂. 1/1.

SECT. I. Fore wing with the apex somewhat acute and produced.

(1)†ESCHATA XANTHORHYNCHA, n. sp.

♂. Differs from *gelida* in the head and thorax being white; palpi orange banded with white; fore legs orange fringed with white; tarsi banded with orange. Fore wing with the area between the postmedial and submarginal lines evenly irrorated with black scales.

Hind wing fuscous black; the cilia white. Underside with the basal two thirds of wings suffused with fuscous black.
Hab. Ceylon (*Butt*). *Exp.* 32 mm.

Type. (2)†Eschata gelida, Wlk. ix. p. 133. Sikhim; Khásis.

(3)†Eschata chrysargyria, Wlk. xxxii. 634. N. China; Sikhim; Assam; Nilgiris;
„ *argentata*, Moore, Lep. Atk. p. 227. Burma; Ceram.

(4)†Eschata xanthocera, n. sp.

♂. Differs from *chrysargyria* in the antennæ being orange; the legs orange fringed with white hair. Fore wing with the postmedial and submarginal lines almost obsolete; the cilia white with golden tips throughout.
Hab. Ceylon (*Green*). *Exp.* 38 mm.

Sect. II. Fore wing with the apex rectangular and not produced.

(5)†Eschata conspurcata, Moore, Lep. Atk. p. 227. Sikhim.

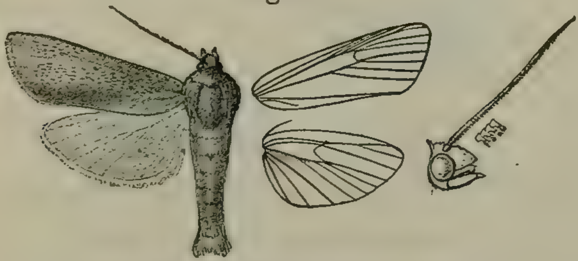
(6)†Eschata percandida, Swinh. Trans. Ent. Soc. 1890, p. 293. Rangoon.

(7)†Eschata ochripes, Hmpsn. Ill. Het. viii. p. 143, pl. 156. f. 23. Nilgiris.

Genus Doratoperas, nov.

Proboscis absent; palpi clothed with hair and hardly extending beyond the maxillary palpi and the long pointed frontal process; antennæ of male serrate and fasciculate, of female minutely serrate and ciliated; tibæ with the spurs short. Fore wing long and narrow; the apex produced and acute in female; vein 3 from before angle of cell; 4, 5 from angle; 6, 7 from a point; 8, 9 from well before upper angle; 10, 11 free. Hind wing with vein 3 from before angle of cell; 4, 5 from angle; 6, 7 from upper angle.

Fig. 43.



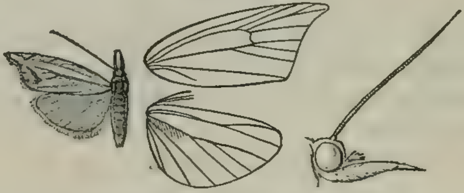
Doratoperas atrosparsellus, ♂. $\frac{1}{1}$.

Type. †Doratoperas atrosparsellus, Wlk. xxvii. 163. Columbia; Brazil.
†*Nystalia zeuzeroides*, Wlk. xxxiii. 761.
†*Donacoscaptes lanceolatus*, Zell. Hor. Ent. Ross. 1881, p. 159, pl. xi. f. 4.
Chilo spectabilis, Feld. Reis. Nov. pl. 137. f. 2.

Genus RAPHIPTERA, nov.

Palpi extending about three times length of head and thickly clothed with hair; maxillary palpi triangularly scaled; proboscis well developed; frons flat; antennæ of female nearly simple. Fore wing with the apex extremely produced and acute; vein 4 absent; 7 absent; 8, 9 stalked; 11 absent. Hind wing with veins 4 and 6 absent; the cell completely open.

Fig. 44.



Raphiptera minimella, ♀. $\frac{3}{2}$.

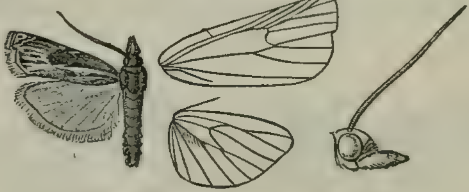
Type. RAPHIPTERA MINIMELLA, Rob. Ann. N. Y. Lyc. ii. 315. U.S.A.

Genus MESOLIA.

Mesolia, Rag. Ann. Soc. Ent. Fr. 1888, p. 282.

Palpi porrect, thickly clothed with hair and extending about twice the length of head; maxillary palpi triangularly scaled; frons with a conical projection; tibiæ with the outer spurs about half the length of inner. Fore wing long and narrow, the apex rounded; the outer margin produced from apex to vein 5; vein 7 when present stalked with 8, 9; 10, 11 when present free. Hind wing with vein 4 usually absent; 6 from upper angle; the upper margin of cell widely separated from 8, 7 curving upwards to anastomose with 8.

Fig. 45.



Mesolia pandavella, ♂. $\frac{3}{2}$.

SECT. I. Fore wing with veins 7 and 11 present.

A. Both wings with vein 4 absent.

a. Antennæ of male thickened and flattened.

Type. (1) MESOLIA PANDAVELLA, Rag. Ann. Soc. Ent. Fr. 1888, p. 282.
N.W. Himalayas; Punjab; S. India; Ceylon.

b. Antennæ of male serrate.

(2)†MESOLIA PLURIMELLA, Wlk. xxvii. 162. Jamaica; San Domingo.

B. Fore wing with veins 4, 5 stalked; hind wing with veins 4, 5 stalked, or 4 absent; antennæ of male thickened and flattened.

(3) MESOLIA INCERTELLA, Zinck. Germ. Mag. iv. 253. U.S.A.
†*Prionopteryx olivella*, Grote, Bull. U.S. Geol. Surv. vi. 274.

c. Both wings with veins 4, 5 from cell.

(4)†MESOLIA WHITEHEADI, E. Wollaston, A. M. N. H. (5) iii. p. 340. St. Helena.

(5)†MESOLIA TENEBRELLA, n. sp.

♀. Fuscous brown irrorated with grey. Fore wing with a black discocellular spot; two indistinct pale lines across apex, with some chestnut between them, the inner continued as an obscure dentate submarginal line with a grey patch beyond it at middle on which are two black streaks. Hind wing paler fuscous.

Hab. Ichang, China. *Exp.* 20 mm.

SECT. II. Fore wing with veins 4, 7 and 11 absent; hind wing with vein 4 absent; antennæ of male ciliated.

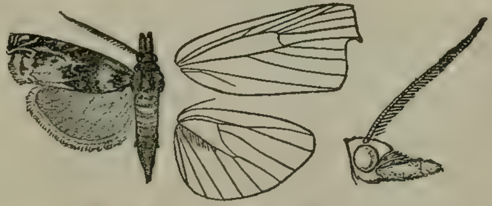
(6) MESOLIA APICISTRIGELLA, Meyr. P. L. Soc. N. S. W. 1879, p. 209. Australia.

Genus PRIONOPTERYX.

Prionopteryx, Steph. Ill. Brit. Ent., Haust. iv. p. 317 (1834).
Nuarace, Wlk. xxvii. 188 (1863).

Palpi thickly clothed with hair and extending about twice the length of head; maxillary palpi triangularly scaled; proboscis well developed; frons with a conical prominence; antennæ of male bipectinated; tibiæ with the spurs long. Fore wing with the outer margin produced from apex to vein 5; vein 3 from before angle of cell; 4, 5 separated at origin; 7 when present from cell; 10 free. Hind wing with vein 3 from before angle of cell; 6 from below upper angle.

Fig. 46.



Prionopteryx nebulifera, ♂. $\frac{1}{1}$.

SECT. I. Fore wing with vein 7 present.

A. Fore wing with vein 11 becoming coincident with 12; hind wing with vein 4 absent.

a. Fore wing with the projection of outer margin blunt.

(1)†PRIONOPTERYX EUGRAPHIS, Wlk. xxvii. 188. San Domingo.

b. Fore wing, the projection of outer margin acute and hooked; antennæ of male with short branches.

(2)*PRIONOPTERYX ELONGATA, Zell. Hor. Ent. Ross. 1877, p. 27, pl. i. f. 9. C. America.

Type. (3)†PRIONOPTERYX NEBULIFERA, Steph. Ill. Brit. Ent., Haust. iv. p. 317. Florida.
Diathrausta octomaculalis, Fern. Ent. Am. iii. p. 127.

B. Fore wing with vein 11 free; the projection of outer margin blunt; hind wing with vein 4 stalked with 5; antennæ of male with long branches.

(4)†PRIONOPTERYX AFRICALIS, n. sp.

♂. Reddish brown suffused with grey; palpi fuscous at sides; antennæ ringed black and white. Fore wing with diffused grey below median nervure; an antemedial patch of dark scales above inner margin; the postmedial line very indistinct, highly angled on vein 5, then inwardly oblique and with streaks of dark scales beyond it; a submarginal brown line with white inner edge angled outwards to the marginal projection, then with three black specks with triangular white marks between them beyond it. Hind wing paler grey-brown; the cilia whitish.

♀. Rather paler and without the dark marks beyond the postmedial line of fore wing.

Hab. Accra, W. Africa; Congo. *Exp.* ♂ 16, ♀ 24 mm.

SECT. II. Fore wing with vein 7 absent; 11 becoming coincident with 12; hind wing with vein 4 absent; antennæ of male with the branches of moderate length.

A. Antennæ of female simple; fore wing with the projection of outer margin acute and hooked.

(5)†PRIONOPTERYX ACHATINA, Zell. Mon. Chil. & Cramb. p. 13. U.S.A.

B. Antennæ of female serrate; fore wing with the projection of outer margin rounded.

(6)†PRIONOPTERYX GRISEOSPARSA, n. sp.

♀. Head, thorax, and abdomen fuscous brown, thickly irrorated with grey. Fore wing brown, thickly irrorated with white; an obscure discocellular brown spot; a white mark at apex and some white on cilia. Hind wing whitish.

Hab. Colorado (*Cockerell*). *Exp.* 30 mm.

List of undetermined Species.

Prionopteryx texturella, Zell. Hor. Ent. Ross. xiii. 28, pl. i. f. 10. Zanzibar.

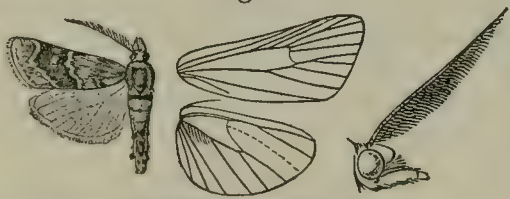
" *bergii*, Zell. Hor. Ent. Ross. xiii. 30, pl. i. f. 11. Buenos Ayres.

Genus Surattha.

Surattha, Wlk. xxvii. 75 (1863).
Calarina, Wlk. xxxv. 1770 (1866).

Palpi porrect and thickly scaled, extending about one and a half times length of head; maxillary palpi triangularly scaled; frons with a conical process; antennæ of male bipectinated, usually with long branches; tibiæ with the spurs long, the outer spurs about two thirds length of inner. Fore wing long and narrow; the apex rounded; vein 3 from near angle of cell; 4, 5 usually on a long stalk; 6, 7 and 10, 11 free. Hind wing with vein 3 from near angle of cell; 5 absent; 6 obsolescent from above middle of discocellulars; 7 anastomosing with 8.

Fig. 47.



Surattha invectalis, ♂. $\frac{1}{1}$.

Sect. I. Fore wing with veins 4, 5 stalked.

Type. (1)†Surattha invectalis, Wlk. xxvii. 76. India; Ceylon;
†*Pindicitora thysbesalis*, Wlk. xxvii. 135. Burma; Java.
†*Scopula nigrifascialis*, Wlk. xxxiv. 1472.
†*Calarina albirenella*, Wlk. xxxv. 1770.

(2)†Surattha neotropicalis, n. sp.

♀. Ochreous brown irrorated with fuscous; abdomen with the base tinged with fulvous. Fore wing thickly irrorated; a fuscous spot at base of median nervure; a medial dark line, slightly sinuous, acutely angled on vein 2, with pale inner edge, and a large fuscous triangular patch beyond it with its base on costa and apex at the angle of the line; a dark discocellular lunule; a minutely dentate submarginal white line, with fuscous on its inner edge and indistinct lunulate brown line beyond it; a marginal series of black specks. Hind wing white; the outer area tinged with fuscous from apex to vein 2.

Hab. Goya, Argentina. *Exp.* 30 mm.

(3)†Surattha albipennis, Butl. P. Z. S. 1886, p. 383. Punjab;
Sind; E. Africa.

(4)†Surattha scitulella, Wlk. xxxv. 1755. S. India; Ceylon.

Sect. II. Fore wing with veins 4, 5 from cell.

A. Antennæ of male with long branches.

(5)*Surattha termia, Meyr. Trans. Ent. Soc. 1885, p. 452.
Australia.

B. Antennæ of male bipectinated, with short branches dilated at extremity.

(6)†SURATTHA FUSCILELLA, Swinh. A. M. N. H. (6) xvi. p. 301. W. India.

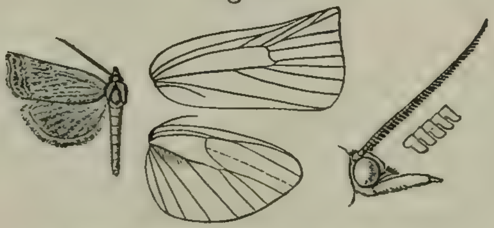
(7 SURATTHA PENTEUCHA, Meyr. Trans. Ent. Soc. 1885, p. 453. Australia.

Genus ANCYLOLOMIA.

Ancylolomia, Hübn. Verz. p. 363 (? 1818).
Jartheza, Wlk. xxvii. 183 (1863).

Palpi porrect, thickly clothed with hair, and extending about three times the length of head; maxillary palpi triangularly scaled; frons oblique; abdomen long; tibiæ with the outer spurs about two thirds length of inner. Fore wing long and narrow, the apex produced; the outer margin excised below apex, then excurved; veins 3, 4, 5 from angle of cell; 7, 8, 9 stalked; 10 free; 11 becoming coincident with 12. Hind wing with vein 3 from close to angle of cell; 4, 5 from angle or stalked; 6 from above middle of discocellulars and obsolescent; 7 anastomosing with 8.

Fig. 48.



Ancylolomia chrysographella, ♂. 1/1.

SECT. I. Antennæ of male with short uniseriate laminate branches, of female simple.

Type. (1) ANCYLOLOMIA TENTACULELLA, Hübn. Europe.

(2) ANCYLOLOMIA CONTRITELLA, H.-S. Europe.

(3) ANCYLOLOMIA CHRYSOGRAPHELLA, Koll. Hüg. Kasch. iv. p. 494.
† „ *capensis*, Zell. Mon. Chil. & Cramb. p. 11. E. & S. Africa; Aden; Japan;
„ *westwoodi*, Zell. Mon. Cramb. p. 11. China; Formosa; throughout India,
† „ *taprobanensis*, Zell. Hor. Ent. Ross. 1877, p. 2, pl. i. f. 8. Ceylon, and Burma; Penang.
„ *sansibarica*, Zell. Hor. Ent. Ross. xiii. 23, pl. i. f. 7. Australia.
„ *indica*, Feld. Reis. Nov. pl. 137. f. 9.
† „ *argentata*, Moore, Lep. Ceyl. iii. p. 382, pl. 184. f. 3.

(4) ANCYLOLOMIA LOCUPLETELLA, Koll. Hüg. Kasch. iv. p. 394. N.W. Himalayas; Ceylon.

SECT. II. Antennæ of male with long uniseriate branches, of female simple.

(5)†ANCYLOLOMIA PECTINATELLA, Zell. Europe.

(6) ANCYLOLOMIA PALPELLA, Schiff. Europe.

(7)†ANCYLOLOMIA SAUNDERSIELLA, Zell. Mon. Chil. & Cramb. p. 10. W. India.
Jartheza biplagella, Moore, P. Z. S. 1872, p. 582, pl. 34. f. 9.
† „ *obstitella*, Swinh. P. Z. S. 1883, p. 880, pl. 57. f. 3.

(8)†ANCYLOLOMIA RESPONSELLA, Wlk. xxvii. 184. Himalayas;
†*Jartheza xylinella*, Wlk. xxvii. 184. W. India.
† „ *cassimella*, Swinh. P. Z. S. 1886, p. 461, pl. 41. ff. 4, 6.

(9)†ANCYLOLOMIA BASISTRIGA, Moore, Lep. Ceyl. iii. p. 382, pl. 184. f. 1. Ceylon.

SECT. III. Antennæ of female serrate.

(10)†ANCYLOLOMIA UNIFORMELLA, n. sp.

♀. Pale ochreous. Fore wing thickly irrorated with fuscous; the irroration rather thicker in the cell, where it forms an obscure fascia. Hind wing pure white.

Hab. Hydrabad, Sind (*Swinhoe*). *Exp.* 38 mm.

List of undetermined Species.

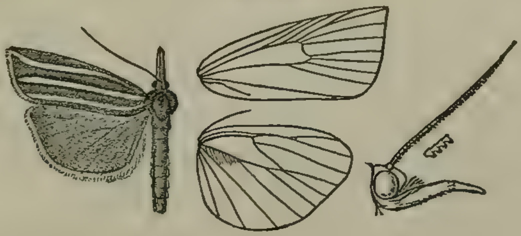
Ancylolomia hipponella, Rag. Ann. Soc. Ent. Fr. (6) viii. p. 279, pl. vi. ff. 11, 12. Algeria.
„ *inornatella*, Staud. Europe.

Genus TALIS.

Talis, Guen. Ind. Micr. p. 86 (1845).
Hednota, Meyr. Trans. Ent. Soc. 1886, p. 270.
Araxates, Rag. Ann. Ent. Soc. Fr. (6) viii. p. 281.

Palpi extending about twice the length of head and thickly clothed with hair; maxillary palpi triangularly scaled; proboscis well developed; frons with a conical prominence; antennæ of male usually ciliated. Fore wing with vein 6 from below upper angle of cell; 7 from the angle; 8, 9 stalked; 10, 11 free. Hind wing with vein 3 from angle of cell; 6 from well below upper angle.

Fig. 49.



Talis bivitellus, ♂. $\frac{1}{1}$.

SECT. I. (*Hednota*). Fore wing with vein 3 from before angle of cell; 5 from above angle; the apex acute.

A. Hind wing with veins 4, 5 from angle of cell.

a. Fore wing with the apex produced and acute.

(1) TALIS MILVELLUS, Meyr. J. L. Soc. N. S. W. iii. p. 181. Australia.

b. Fore wing with the apex rectangular.

(2)†TALIS BIFRACTELLUS, Wlk. xxvii. 174. New Guinea; Australia.

(3) TALIS ARGYROËLIS, Meyr. P. L. Soc. N. S. W. 1882, p. 163. Australia.

(4)†TALIS SUBFUMALIS, n. sp.

♂. Chestnut-brown; palpi blackish; antennæ white on outer side; patagia silvery white. Fore wing with a fuscous-outlined silvery-white fascia from base, somewhat interrupted at middle of cell and double from cell to outer margin, where it joins the marginal series of silvery spots; a fuscous-edged silvery-white fascia below the cell more or less completely interrupted in four places. Hind wing fuscous.

Hab. Port Darwin, Australia. *Exp.* 18 mm.

(5) TALIS AURANTIACUS, Meyr. P. L. Soc. N. S. W. 1878, p. 184. Australia.

(6)†TALIS RECURVELLUS, Wlk. xxvii. 171. W. Australia.

(7) TALIS BIVITTELLUS, Don. Ins. New Holland. Australia.
†*Crambus trivittalis*, Zell. Mon. Chil. & Cramb. p. 34.

(8)†TALIS IMPLETELLUS, Wlk. xxvii. 175. Australia; Tasmania.

(9) TALIS ASTERIAS, Meyr. Tr. Ent. Soc. 1887, p. 250. Swan River, Australia.
? †*Crambus demissalis*[1], Wlk. xxvii. 176.

(10)†TALIS HYDROPHILA, Butl. Trans. Ent. Soc. 1882, p. 36. Hawaii.

(11)†TALIS FLORICOLENS, Butl. Trans. Ent. Soc. 1882, p. 36. Hawaii.

(12)*TALIS PEDIONOMA, Meyr. Tr. Ent. Soc. 1885, p. 453. Australia.

(13)*TALIS LEUCOPHTHALMA, Meyr. N. Z. Journ. Sci. i. p. 186. New Zealand.

B. Hind wing with veins 4, 5 stalked.

a. Antennæ of male ciliated.

(14) TALIS ARGENTOSUS, Snell. Tijd. Ent. xxxvi. p. 657, pl. 3. f. 2. Centr. America; Bolivia; Argentina.

(15)†TALIS PLENIFERELLUS, Wlk. xxvii. 173. Australia.
Crambus aurosus, Feld. Reis. Nov. pl. 137. f. 31.

(16)†TALIS PERLATALIS, Wlk. xxvii. 174. Australia; Tasmania.

(17) TALIS GRAMMELLUS, Zell. Mon. Chil. & Cramb. p. 46. Australia; Tasmania.
Crambus enneagrammos, Meyr. P. L. Soc. N. S. W. 1878, p. 194.

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[1] Walker's description does not agree with his supposed type.

(18) TALIS ACONTOPHORUS, Meyr. P. L. Soc. N. S. W. 1882, p. 167. Australia; Tasmania.

(19) TALIS LONGIPALPELLUS, Meyr. P. L. Soc. N. S. W. 1878, p. 196. Australia.

b. Antennæ of male serrate.

(20)†TALIS OPULENTUS, Zell. Mon. Chil. & Cramb. p. 46. Australia.

(21)†TALIS RELATALIS, Wlk. xxvii. 172.
†*Crambus argyroneurus*, Zell. Mon. Chil. & Cramb. p. 47. Australia; Tasmania.

(22) TALIS PANSELENELLUS, Meyr. P. L. Soc. N. S. W. 1882, p. 167. Australia; Tasmania.

c. Antennæ of male bipectinated.

(23) TALIS HOPLITELLUS, Meyr. P. L. Soc. N. S. W. 1878, p. 188. Australia.

SECT. II. (*Talis*). Fore wing with veins 4, 5 stalked, the apex rounded.

A. Antennæ of male ciliated.

Type. (24) TALIS QUERCELLUS, Schiff. Europe.

(25) TALIS PULCHERRIMUS, Staud. Europe.

B. Antennæ of male pectinated.

(26)*TALIS AFRA, Baker, Trans. Ent. Soc. 1894, p. 49. Egypt.

List of undetermined Species.

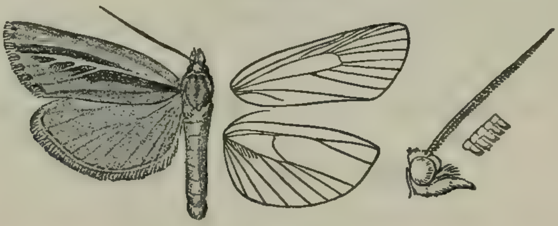
Talis invalidellus, Meyr. J. L. Soc. N. S. W. iii. p. 193. Tasmania.
Thisanotia pedalarcha, Meyr. Trans. Ent. Soc. 1885, p. 454. Australia.
Hednota xylophæa, Meyr. P. L. Soc. N. S. W. (2) i. p. 1038. Australia.
„ *toxotes*, Meyr. Tr. Ent. Soc. 1887, p. 249. Australia.
„ *gelastis*, Meyr. Tr. Ent. Soc. 1887, p. 250. Tasmania.
„ *oxyptera*, Meyr. Trans. Ent. Soc. 1888, p. 243. Australia.
Thisanotia œnochrois, Meyr. Trans. Ent. Soc. 1889, p. 520. New Guinea.
Talis dilatatalis, Christ. Europe.
„ *arenella*, Rag. Europe.

Genus CHARLTONA.

Charltona, Swinh. P. Z. S. 1885, p. 879.

Palpi porrect, clothed with rough hair and projecting about one and a half times length of head; maxillary palpi triangularly dilated with hair; frons rounded; tibiæ with the outer spurs about two thirds length of inner; wings long and narrow. Fore wing with the apex rectangular; vein 3 from before angle of cell; 4, 5 well separated at origin; 7 straight and well separated from 8, 9; 10 free; 11 curved and approximated to 12. Hind wing with vein 3 from near angle of cell; 4, 5 from angle and approximated for a short distance; 6 absent; 7 anastomosing with 8.

Fig. 50.



Charltona cervinella, ♂. 1/1.

SECT. I. Antennæ of male bipectinate, with short branches dilated at extremity.

Type. (1)†CHARLTONA KALA, Swinh. P. Z. S. 1885, p. 879, pl. 57. f. 4. W. & S. India.

SECT. II. Antennæ of male with short uniseriate laminated branches.

(2)†CHARLTONA LAMINATA, n. sp.

♂. Head, thorax, and fore wing uniform black-brown, the last with diffused long black scales with pale bases in interspaces of inner and outer areas; abdomen and hind wing fuscous brown.
Hab. Burma. *Exp.* 34 mm.

(3)†CHARLTONA AURANTIFASCIA, n. sp.

Head and thorax fuscous grey, the vertex of head and patches on pro- and metathorax orange; abdomen orange. Fore wing dark silvery grey, with a broad orange fascia from base in and below cell and along vein 2 to beyond middle; a medial black line slightly excurved below costa, where there is an orange spot beyond it; a discocellular black lunule with an orange fascia from it to outer margin. Hind wing pale orange, with the apical area fuscous.
Hab. Accra; Gambia. *Exp.* ♂ 26, ♀ 40 mm.

(4)†CHARLTONA BIVITELLA, Moore, P. Z. S. 1872, p. 581, pl. 34. f. 8. Bombay.

(5)†CHARLTONA CERVINELLA, Moore, P. Z. S. 1872, p. 581, pl. 34. f. 7. W. & S. India.
†*Chilo interruptellus*, Moore, P. Z. S. 1872, p. 581, pl. 34. f. 5.

(6)†Charltona inconspicuella, Moore, P. Z. S. 1872, p. 582, pl. 34. f. 6. Bombay.

(7)†Charltona desistalis, Wlk. xxvii. 165; Moore, Lep. Ceyl. iii. pl. 184. f. 10. Ceylon.

(8)†Charltona consociella, Wlk. xxvii. 159. Bengal.

(9)†Charltona discella, Wlk. xxvii. 141. S. Africa; Madagascar.

Sect. III. Antennæ of male with long uniseriate branches.

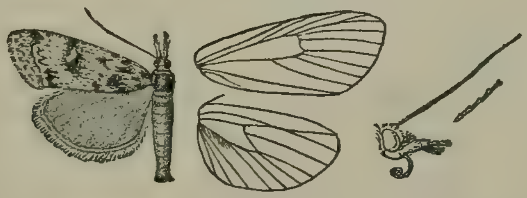
(10)†Charltona ortella, Swinh. P. Z. S. 1886, p. 461, pl. 41. f. 3. India.

Genus Scenoploca.

Scenoploca, Meyr. Trans. N. Z. Inst. 1882, p. 9.

Palpi with a projecting tuft of hair below 2nd joint, the 3rd naked; maxillary palpi triangularly scaled; proboscis present; antennæ somewhat annulated and ciliated. Fore wing with veins 3, 4, 5 from near angle of cell; 7 from upper angle; 8, 9 stalked; 10, 11 free. Hind wing with vein 3 from before angle of cell; 4, 5 from angle; 6 from well below upper angle. Female with the wings aborted and incapable of flight.

Fig. 51.



Scenoploca petraula, ♂. $\frac{3}{1}$.

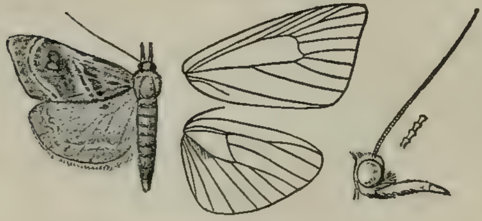
Type. *Scenoploca petraula, Meyr. Trans. N. Z. Inst. 1882, p. 9. New Zealand.

Genus Gadira.

Gadira, Wlk. xxxv. 1742 (1866).
Cryptomima, Meyr. Trans. N. Z. Inst. 1882, p. 8.

Palpi projecting about twice the length of head, and thickly clothed with hair; maxillary palpi triangularly scaled; proboscis well developed; frons flat; antennæ somewhat annulate; tibiæ with the spurs long. Fore wing with the apex produced and acute; a tuft of raised scales at lower angle of cell; veins 3, 4, 5 from near angle; 6 from well below upper angle; 7 from angle; 8, 9 stalked; 10, 11 free. Hind wing with vein 3 from angle of cell; 4, 5 shortly stalked; 6 from well below upper angle.

Fig. 52.



Gadira acerella, ♂. $\frac{3}{2}$.

Type. †Gadira acerella, Wlk. xxxv. 1742. New Zealand.
Botys mehanga, Feld. Reis. Nov. pl. 137. f. 27.

List of unrecognized Genera.

Seriocrambus stylatus, Wallengr. Eugenies Reise, Lep. p. 383, pl. 7. f. 7. Argentina.
Elethyia (*Prionopteryx*) *subscissa*, Christ. Hor. Ent. Ross. xii. p. 277, pl. vii. f. 18. Siberia.
Cephis galleriellus, Rag. Deutsch. e. Z., Lep. v. p. 295, pl. iii. f. 12. Tunis.
Pachymorphis subductellus, Möschl. Abh. Senck. Ges. xvi. p. 324. Porto Rico.
Epichilo parvellus, Rag. Ann. Soc. Ent. Fr. 1888, p. 278. S. India.
Tauroscopis gorgopis, Meyr. Tr. N. Z. Inst. xx. p. 69. New Zealand.

Species described as Crambinæ *which are omitted.*

Chilo carnifex, Cyl., from Madagascar, reference unknown.
Crambus patulellus, Wlk. xxvii. 163. Type lost, description not recognizable.
„ *sinensellus*, Wlk. xxvii. 167, belongs to the *Pyraustinæ.*
„ *concinalis*, Fthl. Mag. de Zoologie, 1839, pl. 26. f. 2, belongs to the *Tineidæ.*
„ *leucocinctus*, Wlk. xxvii. 169, belongs to the *Phycitinæ.*
„ *ruptellus*, Wlk. xxvii. 173, belongs to the *Deltoidinæ.*
„ *vetustellus*, Wlk. xxvii. 176=*cygnosellus*, Wlk. xxxv. 1758, belongs to the *Phycitinæ.*
„ *ochraceellus*, Wlk. xxvii. 177, belongs to the *Tortricinæ.*
Ciampa defixella, Wlk. xxvii. 180, belongs to the *Geometridæ.*
Themma divisa, Wlk. xxvii. 186=*Tunza promptella*, Wlk. 196=*Doryodes acutaria*, H.-S., belongs to the *Deltoidinæ.*
Juncaria nonagrioides, Wlk. xxvii. 187, belongs to the *Noctuidæ.*
Begunna xanthoides, Wlk. xxvii. 190, belongs to the *Tortricinæ.*
Safra metaphæella, Wlk. xxvii. 195, belongs to the *Tineidæ.*
Samana falcatella, Wlk. xxvii. 197, belongs to the *Geometridæ.*
Adena xanthialis, Wlk. xxvii. 198, belongs to the *Pyraustinæ.*
Acara morosella, Wlk. xxvii. 199, belongs to the *Galleriinæ.*
Zekelita equalisata, Wlk. xxvii. 199, belongs to the *Deltoidinæ.*
Aquita horridella, Wlk. xxvii. 200, belongs to the *Sarrothripinæ.*
Pharga fasciculella, Wlk. xxvii. 201. Type lost, description not recognizable.

Arucha indicatalis, Wlk. xxvii. 202=*Etiella zinckenella*, belongs to the *Phycitinæ*.

Affa bipunctella, Wlk. xxvii. 202, belongs to the *Tortricinæ*.

Phachthia lignigeralis, Wlk. xxx. 979, belongs to the *Deltoidinæ*.

Tomissa concisella, Wlk. xxx. 978. Type lost, description not recognizable.

Ancylolomia siccella, Wlk. xxxv. 1750, belongs to the *Tineidæ*.

Crambus indotatellus, Wlk. xxxv. 1752=*commixtalis*, Wlk., belongs to the *Pyraustinæ*.

,, *acutellus*, Wlk. xxxv. 1753=*venalis*, Grote, belongs to the *Pyraustinæ*.

,, *bogotanellus*, Wlk. xxxv. 1754=*helviusalis*, Wlk., belongs to the *Pyraustinæ*.

,, *aurifusellus*, Wlk. xxxv. 1756, belongs to the *Anerastiinæ*.

,, *melanospilellus*, Wlk. xxxv. 1759. Type lost, description not recognizable.

,, *dirutellus*, Wlk. xxxv. 1760. Type lost, description not recognizable.

Eromene apertella, Wlk. xxxv. 1762, belongs to the *Tortricidæ*.

Tauba venosella, Wlk. xxxv. 1767, belongs to the *Pyralidinæ*.

Ertzica maximella, Wlk. xxxv. 1768, belongs to the *Galleriinæ*.

Batiana remotella, Wlk. xxxv. 1771. Type lost, description not recognizable.

Rupela degenerella, Wlk. xxviii. 524, belongs to the *Lithosiinæ*.

Crambus fœdellus, Wlk. xxxv. 1757, belongs to the *Galleriinæ*.

,, *tincticostellus*, Wlk. xxvii. 167, belongs to the *Pyraustinæ*.

Catagela leucania, Feld. Reis. Nov. pl. 137. f. 13, belongs to the *Anerastiinæ*.

Crambus sabulosellus, Wlk. xxvii. 178, is a *Scoparia*.

,, *trivirgatus*, Feld. Reis. Nov. pl. 137. f. 29, is a *Scoparia*.

,, *rotuellus*, Feld. Reis. Nov. pl. 137. f. 30, is a *Scoparia*.

Eromene transcissella, Wlk. xxxv. 1762, belongs to the *Tortricinæ*.

Crambus humerellus, Wlk. xxxv. 1758, belongs to the *Tortricinæ*.

,, *submarginellus*, Wlk. xxxv. 1760, belongs to the *Tortricidæ*.

Mixophila renatusalis, Wlk. xvii. 484=*Crambus ermineus*, Moore, Lep. Ceyl. iii. p. 580, pl. 184. f. 7=*Angonia crambidalis*, Snell. Tijd. v. Ent. 1893, p. 56, pl. 3. f. 1, belongs to the *Hydrocampinæ*.

Crambus whiteleyi, Butl. Ill. Het. iii. p. 78, pl. 60. f. 2, is a *Hypena*.

,, *sabulinus*, Butl. A. M. N. H. 1879, iv. p. 455, belongs to the *Phycitinæ*.

,, *occultilinea*, Wlk. xxvii. 168. Type lost, description not recognizable.

Bulina solitella (*Libuna*, Moore, Lep. Ceyl. iii. p. 379), Wlk. xxxv. 1767. Type lost, description not recognizable.

Diptycophora inornata, Butl. Trans. Ent. Soc. 1886, p. 440, belongs to the *Noctuidæ*.

Surattha eremialis, Swinh. P. Z. S. 1889, p. 422, belongs to the *Pyralinæ*.

Ugra parallela, Wlk. xxvii. 189, belongs to the *Chrysauginæ*.

Cirrochrista diaphana, Hmpsn. Ill. Het. viii. p. 135, pl. 155. f. 11, belongs to the *Pyraustinæ*.

Pelena unicolor, Moore, Lep. Ceyl. iii. p. 386, pl. 184. f. 16, belongs to the *Hydrocampinæ*.

Taseopteryx sericea, Butl. Trans. Ent. Soc. 1883, p. 63, belongs to the *Deltoidinæ*.

Metothemma angulipennis, Butl. Trans. Ent. Soc. 1883, p. 62, belongs to the *Deltoidinæ*.

" *acuminata*, Butl. Trans. Ent. Soc. 1883, p. 62, belongs to the *Deltoidinæ*.

" *striata*, Butl. Trans. Ent. Soc. 1883, p. 63, belongs to the *Deltoidinæ*.

Eromene vetustella, Wlk. xxxv. 1763, is a *Nola*.

Crambus perspicuus, Wlk. Ent. v. 155. Type lost, description not recognizable.

ADDENDUM (Feb. 18, 1896).

SEDENIA, Guen. Delt. & Pyr. p. 249 (1854), before *Eromene*, from which it is distinguished by the abortion of the proboscis.

Type. SEDENIA CERVALIS, Guen. p. 250, pl. 3. f. 3=†*itonusalis*, Wlk. xviii. 794, and †*pictoalis*, xix. 1016. Australia.

SEDENIA RUPALIS, Guen. p. 250. Australia.

6. On *Uintacrinus*: a Morphological Study.

By F. A. BATHER, M.A.[1]

[Received December 3, 1895.]

(Plates LIV., LV., & LVI.)

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1. Introduction and History of Discovery, p. 974.
2. Morphological Description of *Uintacrinus socialis*, p. 978.
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4. Summary, p. 1002.
5. The Literature of *Uintacrinus*, p. 1003.
6. Explanation of the Plates, p. 1004.

1. INTRODUCTION AND HISTORY OF DISCOVERY.

Among those extinct forms that have evoked the curiosity of naturalists, the peculiar unstalked crinoid *Uintacrinus* holds a foremost place. Not merely its rarity and its beauty have caused it to receive unusual attention, but also the circumstances that, though found in the Cretaceous rocks, it reminds one strongly of forms extinct since the Carboniferous period, and yet cannot be joined to them, so far as we are aware, by any chain of ancestors. Like the other unstalked and free-swimming crinoid of the Chalk, *Marsupites testudinarius*, it is a forlorn foundling, with not even a birth-mark to reveal its parentage. The riddle with which *Uintacrinus* perpetually challenges the naturalist may perhaps be

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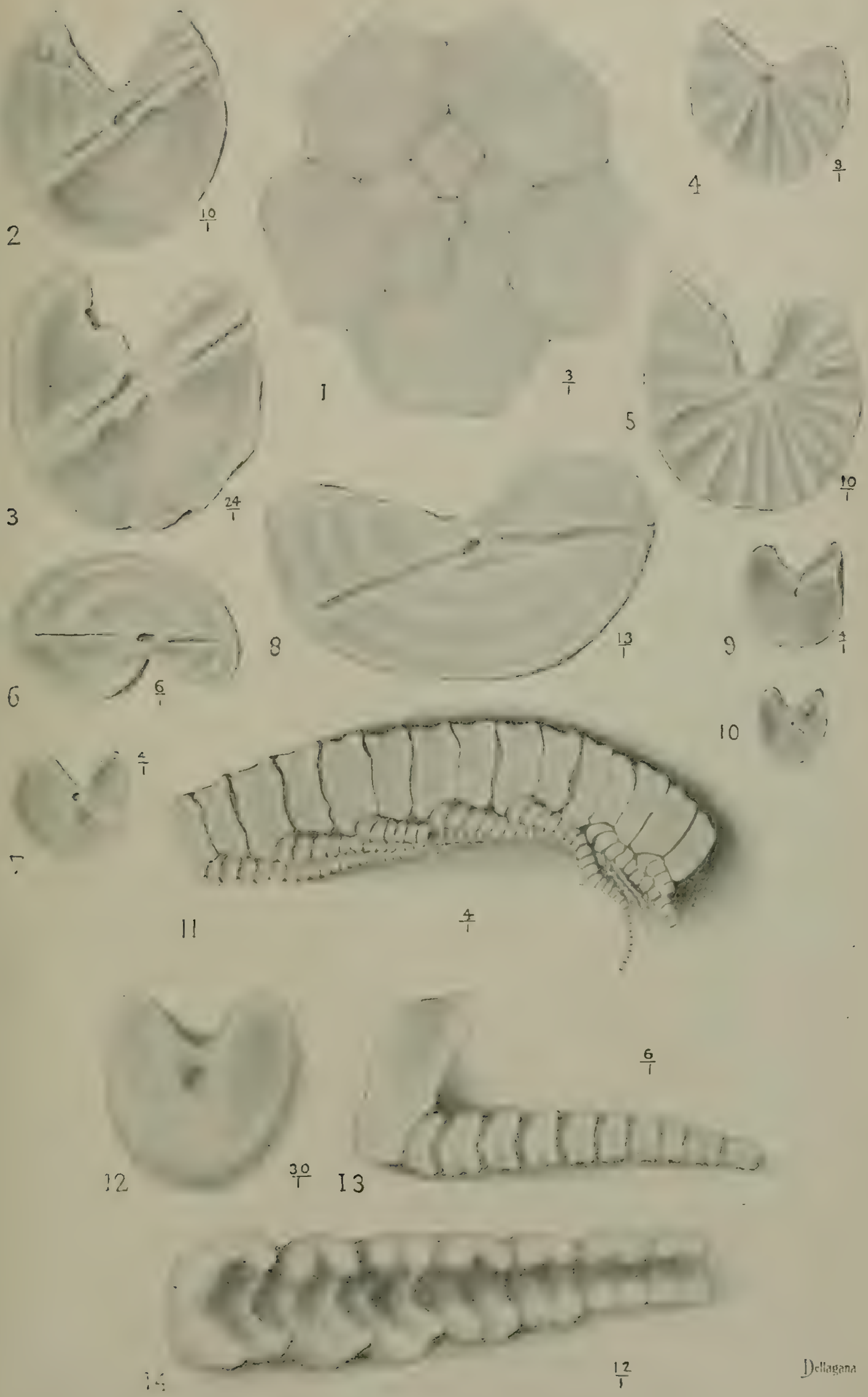
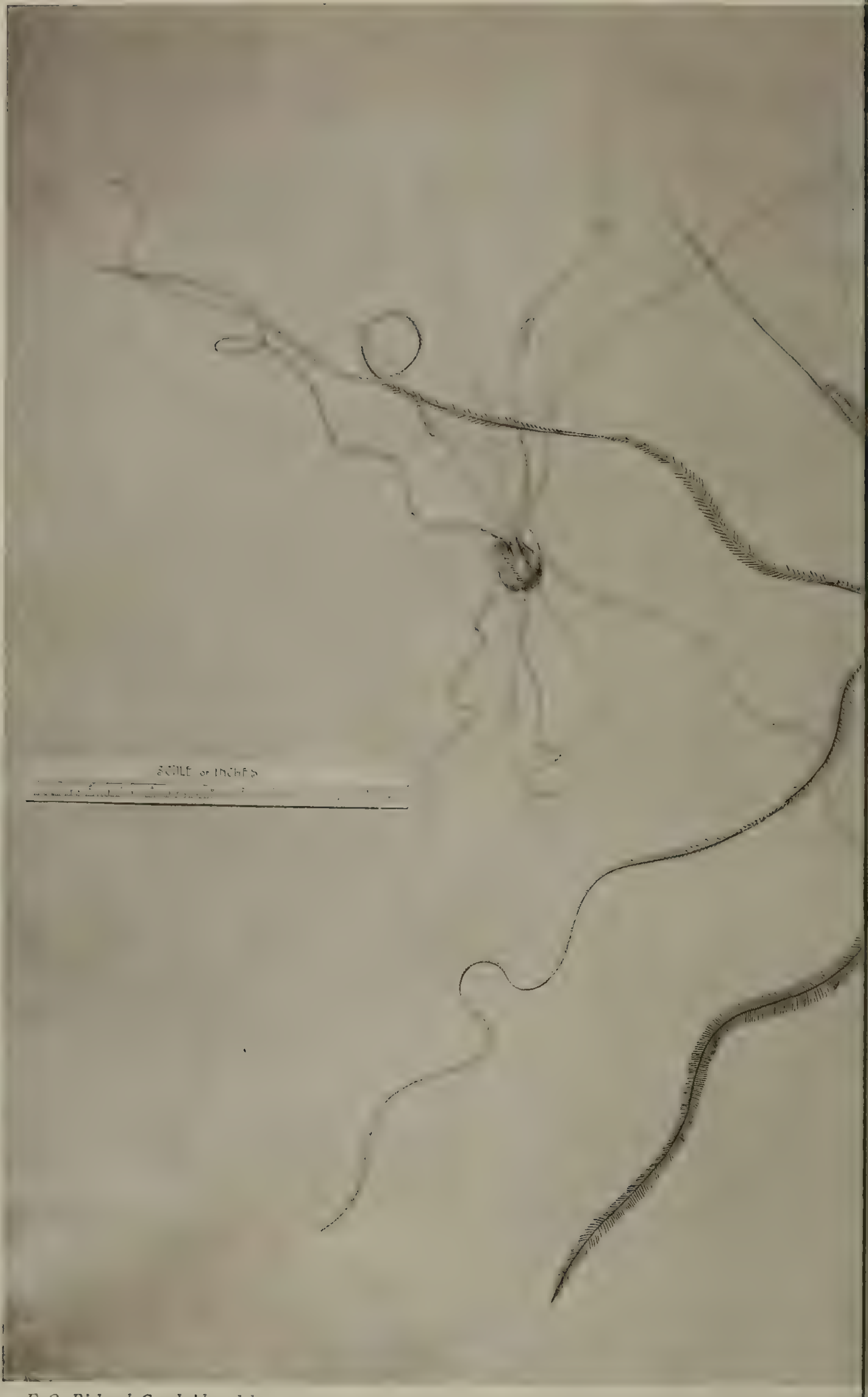
[1] Communicated by Sir W. H. FLOWER, K.C.B., P.Z.S.



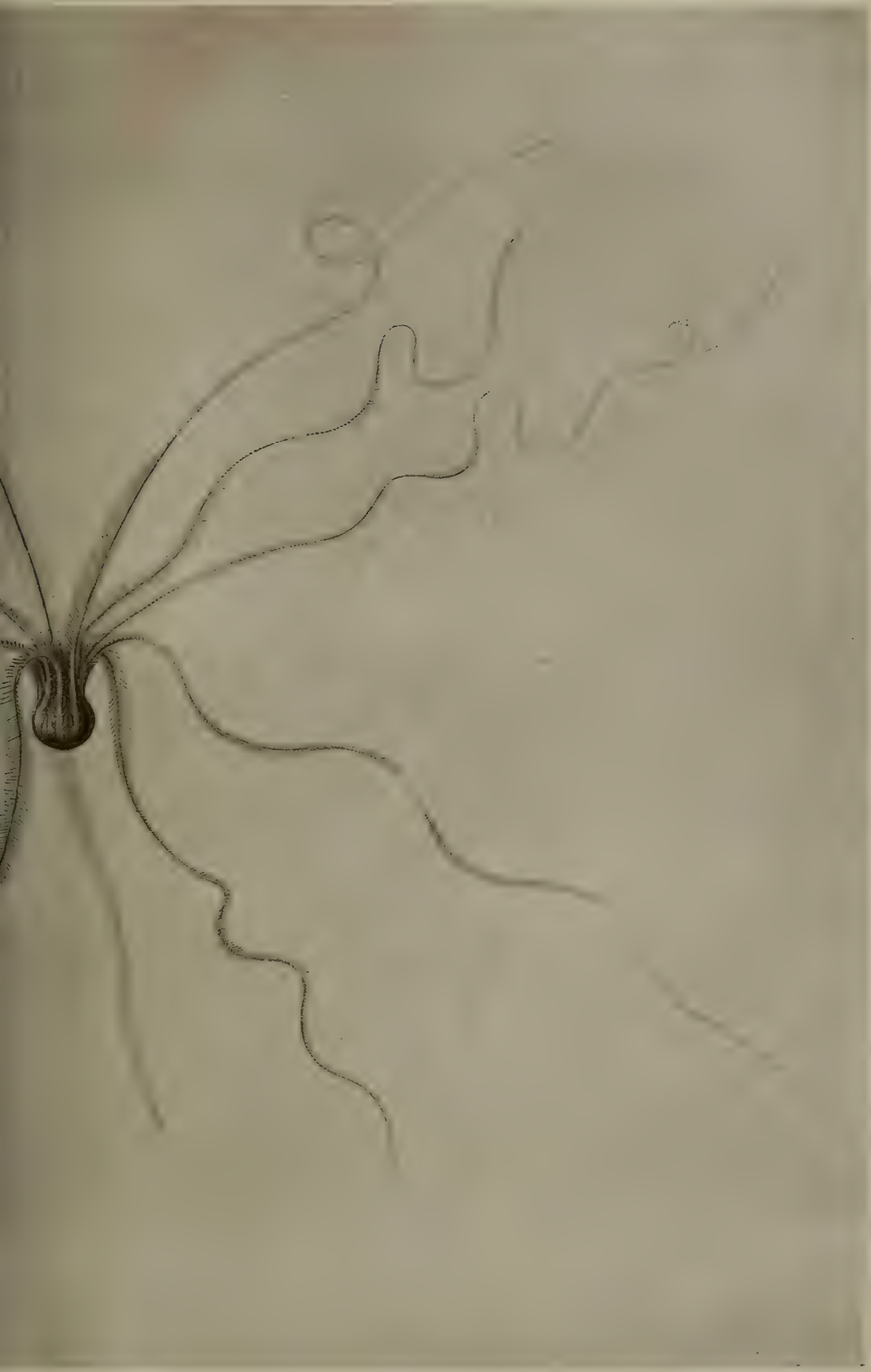
UINTACRINUS SOCIALIS.

BRITISH MUSEUM NATURAL HISTORY



F. O. Pickard, Cambridge, del.

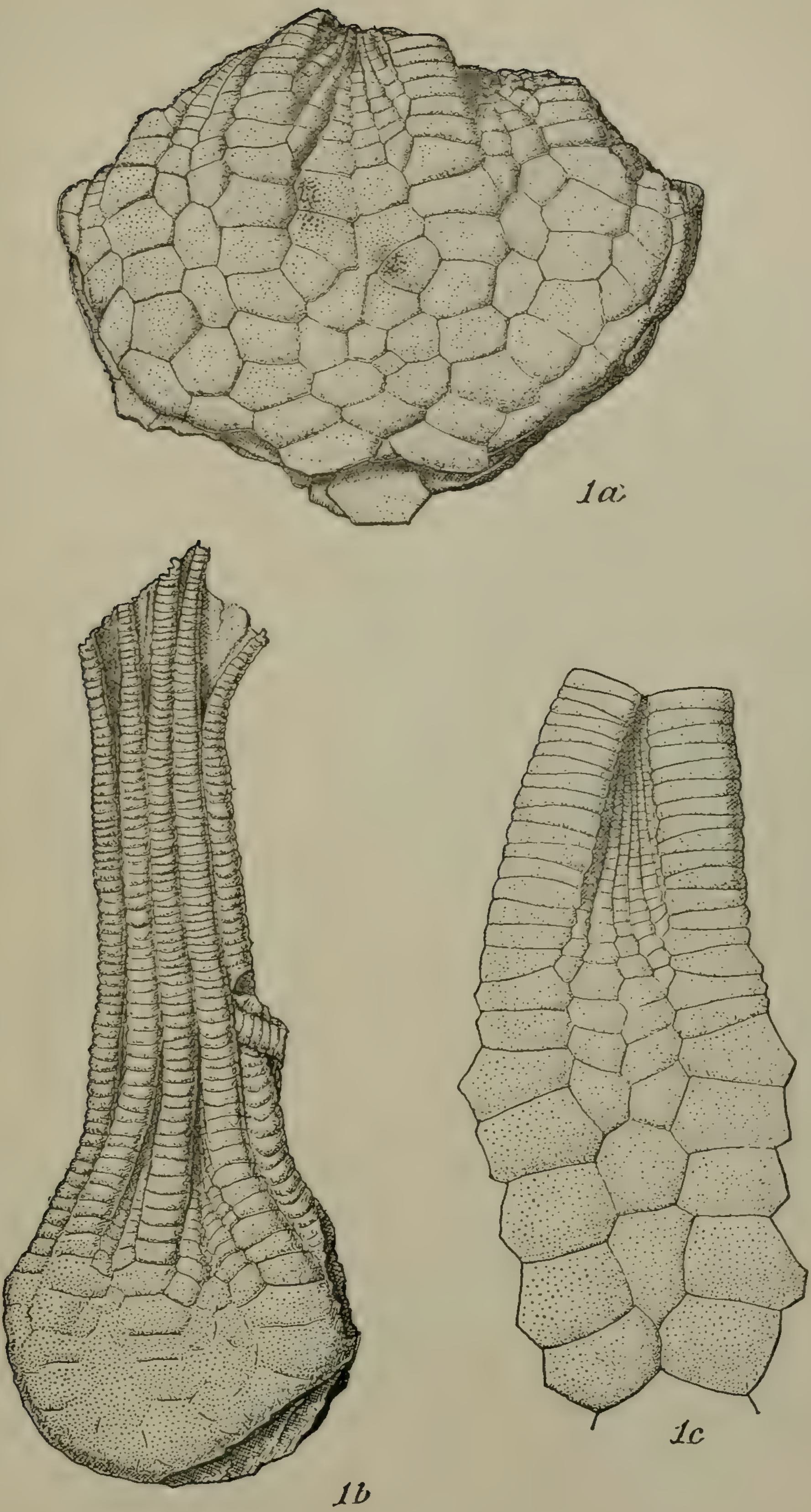
Restoration of UI



ACRINUS SOCIALIS.

Bemrose, Phototyp.

BRITISH MUSEUM
NATURAL HISTORY



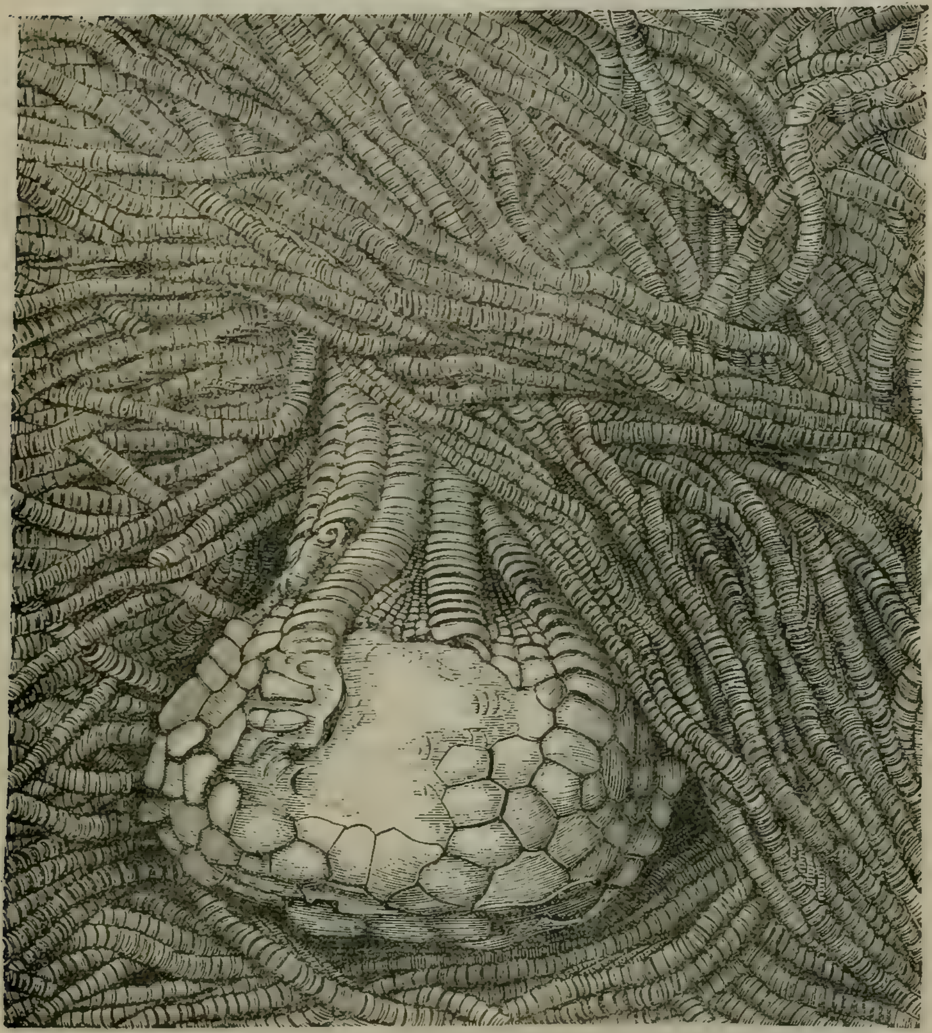
C. R. Keyes del.

UINTACRINUS SOCIALIS.

solved, not by renewed speculation, but with the aid of fresh facts and more detailed description. To bring such aid is the object of this paper.

It was in 1870 that, through one of the exploring expeditions of Prof. O. C. Marsh (**1**), an imperfect specimen was found in the eastern Uintah mountains, lying "in a stratum of yellow calcareous shale" and immediately over "a thin layer full of *Ostrea congesta*, Conrad, a typical Cretaceous fossil," and associated with the scales of a *Beryx*. This specimen was not sufficient for description, but in 1875 further specimens, somewhat exposed and weathered, were discovered by Prof. Mudge and his party in the middle of

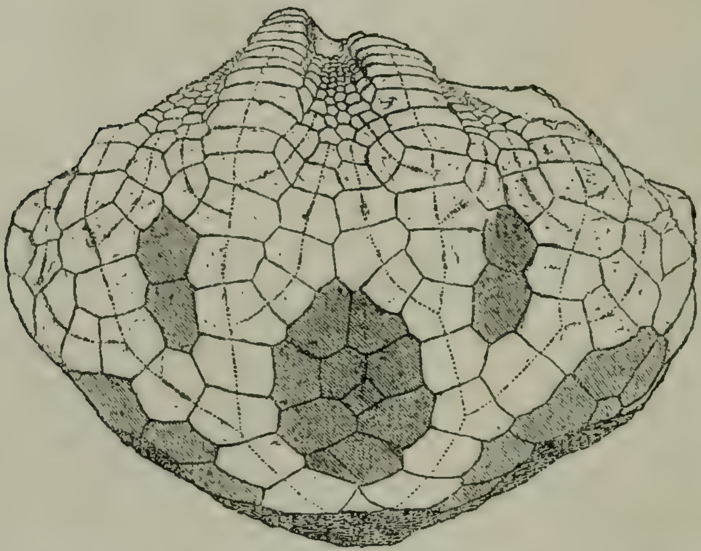
Fig. 1.



Uintacrinus socialis, one of the co-types, from Niobrara Chalk, W. Kansas, now in Yale College Museum. Reproduction of Grinnell's illustration, Amer. Journ. Sci. vol. xii. pl. iv. fig. 2. The lower portion of a weathered specimen is seen surrounded by a mass of arms belonging to other individuals. Natural size.

the Niobrara Chalk of Trigo Co., W. Kansas, associated with the Odontornithes, Pterodactyls, and Mosasauroid reptiles of that formation. One of these crinoids, which was sent to the Yale College Museum, served Grinnell as the type of genus and species, *Uintacrinus socialis*, which he described in 1876 (2). The specimens studied by him showed neither base nor arms clearly (fig. 1, p. 975). Some specimens sent at the same time from Prof. Mudge to F. B. Meek were well described by the latter (3), who added a few details concerning the interradial and interdistichal areas (fig. 2). Still there remained to be determined "the nature of the base (whether composed of five pieces surrounding a central piece, and whether or not it was connected with a column), the presence or absence of subradial pieces, and whether there is an anal series of pieces differing from each of [the other] interradial series."

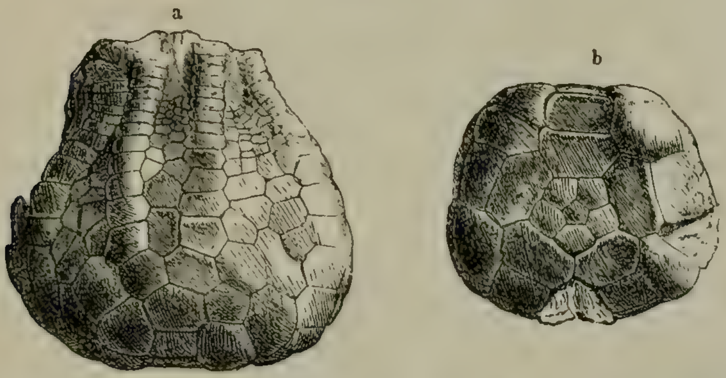
Fig. 2.



Uintacrinus socialis. Reproduction of Meek's fig. B, in Bull. U.S. Geol. & Geog. Survey, ii. p. 375. "A flattened specimen, [in which] all the body-plates of one side are seen. The plates of one interradial area (middle of figure) [interbrachials, *mihi*] and parts of two others, one on each side, as well as those of two of the interaxillary areas [interdistichals, *mihi*], are shaded to distinguish them from the plates of the radial system [fixed brachials, *mihi*], which latter are marked with dotted lines." Natural size. This specimen is in the U.S. National Museum, and has been re-figured by W. B. Clark (8). See page 982 and Pl. LVI. fig. 1 *a*.

Almost contemporaneously a specimen of this genus, but representative of another species, was discovered in Europe at a slightly higher horizon, namely in the lowest division of the Lower Senonian, in the *Marsupites* zone, near Recklinghausen in Westphalia. This was exhaustively described and discussed by Schlueter in 1878 (4), under the name *U. westfalicus* (fig. 3). In this specimen the arms were not well preserved; the base, which was clearly seen, confirmed the impression of previous writers that the genus was unstalked, and showed that there was but one circlet of basals; the interradial and interdistichal areas were fairly visible all round the specimen, and though "the contour and disposition of the plates differed in the different interradii," there was no such variation as to point to the existence of a special anal series. It is chiefly in the arrangement of the interradial plates that this species differs from *U. socialis*.

Fig. 3.



Uintacrinus westfalicus, type-specimen from the Lower Senonian of Recklinghausen, now in the Museum of Bonn University. *a*, from the side; *b*, from below. The illustration, reproduced from Zittel (**5**) p. 374 & (**11**) p. 139, by kind permission of Prof. Karl von Zittel, is a *reversed* copy of Schlueter (**4**) pl. iv. figs. 1 & 2, reduced to $\frac{4}{5}$ natural size, *not* natural size as invariably stated.

The American species was more fully described by W. B. Clark in 1893 (**8**), but his specimens did not throw much more decided light on its structure (Pl. LVI.). In the following year, however, S. W. Williston and B. H. Hill (**9**) published some notes on specimens discovered in 1891 by Prof. E. E. Slosson. These specimens were the first among those found in America to show the base with the desired clearness, and were in other respects far superior to any specimens of *U. socialis* previously collected. They were found near Elkader, on the Smoky Hill River, W. Kansas, and their mode of occurrence is thus described by Prof. Williston:—"While all the colonies hitherto discovered have been exposed and more or less weathered, the present one was found in position, covered by the soft blue shale. The animals had lived so closely together that their very long arms had become inextricably entangled, and, by consolidation, had formed a dense calcareous plate, about one-third of an inch in thickness in the middle of the plate, but thinning out at the margin. About one-half of the thin slab as thus formed had been washed away; the remainder, as now restored in the University Museum, measures about six feet by three or four, and has upon its underside nearly one hundred of the crinoids, the greater part of which are perfectly preserved. The calyces all lie flattened out, showing, in some cases, the basal plates, but, as might be expected, never the upper or ventral portions. The interlacing of the arms prevents the tracing of any to the extremity."

Two slabs from the same locality, collected by Mr. H. T. Martin, have recently been purchased by the Trustees of the British Museum. Since they are the only specimens of the genus in England, and probably the only specimens of *U. socialis* as yet received in Europe[1], the description of them that Dr. Henry Woodward has kindly permitted me to draw up may interest English naturalists. At the same time, the more careful investigation that these exceedingly beautiful specimens have rendered possible has enabled a few details to be more accurately filled in.

The larger of the two slabs has an irregular area of about 2400 sq. cm., and contains 23 cups, one of which shows the base very clearly; the arms are also well shown. This slab represents the unweathered condition of the fossil; the matrix is a soft, calcareous yellow shale, in general aspect reminding one of the Solenhofen Lithographic Stone, but much softer and more friable. According to Prof. S. Calvin[2], it is composed of microscopic organisms identical with those of true chalk. Where the crinoids are massed together, their calcareous remains form, as described by Prof. Williston, a dense plate. As a rule, however, the separate plates and ossicles of the crinoid are far too easily detached from the matrix. The calyces are flattened out, and the arm-ossicles also are much compressed, so that their examination is not easy. This slab, registered E 6527, is now exhibited in Gallery No. 8 of the Geological Department of the British Museum (Nat. Hist.). For convenience of reference the cups contained on it have been lettered *a*, *b*, *c*, &c.

The smaller of the two slabs, with an area of 420 sq. cm., contains the remains of 7 cups, of which three show the basal circlet. This slab represents the weathered condition of the fossil, which fact, however, rather facilitates than hinders study. The shale is a pale bluish grey, and the pale yellow plates stand out clearly, both in colour and relief. This slab is registered E 6328, and the cups are lettered α, β, γ, &c.

Both these slabs show a feature of fossilization hitherto unnoticed in *Uintacrinus*; in fact, so far as I am aware, unknown among crinoids. That is, the preservation of a thin layer of carbonaceous material, which lines the interior of the calyx. Unfortunately, the traces of microscopic structure exhibited by this are of the most meagre description.

2. MORPHOLOGICAL DESCRIPTION OF UINTACRINUS SOCIALIS.

The crinoid consists of a crown only. There is no trace of a stem, unless, indeed, the central apical plate be the diminished representative of the proximal columnal, for which view there is no evidence.

[1] Geh. Professor Karl von Zittel informs me, in a letter dated January 18, that the Munich Museum has also acquired similar specimens.

[2] "The Niobrara Chalk." Presidential Address, Proc. Amer. Assoc. xliii. pp. 197–217 (1894); and in a private letter to the author, January 1896.

The **crown** consists of a relatively large, globose calyx and 10 long arm-branches (Pl. LV.).

The **calyx** was flexible, as shown by the thinness of the component plates, the absence of fractures, and the regularity of the preserved specimens. The dorsal cup alone is known to us. The **tegmen** was pliable, and probably but slightly, if at all, plated; at any rate, none of the ventral plates are exposed, "nor," as says Mr. Hill (9), "has it been possible to expose them by dissecting away the plates." Neither does a transverse section of a calyx, at about the level of the 6th fixed distichal, show more than a confused calcareous mass.

The **dorsal cup** (see figs. 4 and 5) consists of three categories of elements: (*a*) the apical system; (*b*) the brachial elements, which are radial and primary; (*c*) the secondary, supplemental plates, viz. (i.) interbrachials, (ii.) interdistichals, (iii.) interpinnulars.

The **apical system** (Pl. LIV. fig. 1) consists of (i.) the centrale or central apical plate; (ii.) 5 interradially situate basals surrounding it; (iii.) 5 radials succeeding the basals.

The **centrale** is pentagonal, but in specimens examined not quite regular. In specimen *e* its greatest diameter is 1·5 mm. It is perfectly smooth, showing no signs either of a stem-attachment or of partition into more than one original element. Its homologies are therefore doubtful, as its structure and position permit it to represent either a relic of a stem, or a fused infrabasal circlet, or even, as some would have it, an additional element altogether to which the name "dorsocentral" might be strictly applicable. I have recently[1] given reasons for rejecting the term and the idea "dorsocentral." Which of the other alternatives be correct is to be decided, if at all, by reference to the affinities and origin of the genus, as to which we are, at this stage of the inquiry, quite in the dark.

The **basals** (Pl. LIV. fig. 1) are 5, equal, regular, and pentagonal. They surround the apical plate and meet each other by adjacent sides. The sides enclosing the upper angle of each basal are slightly curved convexly, thus giving the basals a petaloid aspect. The measurements of the basals in specimen *e* are: height 3·4 mm.; width below, 1·0 mm.; width above, 3·5 mm.

The **radials** (fig. 5 and Pl. LIV. fig. 1) are 5, equal, heptagonal or hexagonal according as the upper sides of the two basals on which each radial rests make a reëntrant angle or a straight line. They meet each other by adjacent sides, support the first primibrachs above, and abut on the proximal interbrachials on either side. Their measurements in specimen *e* are: in one radius, height 5·0 mm.; width below, 4·9 mm.; width in middle, 8·7 mm.; width above, 5·75 mm.: in another radius, height 6·0 mm.; width below, 4·5 mm.; width in middle, 8·0 mm.; width above, 4·5 mm.

The **fixed brachial** elements that enter into the composition of the dorsal cup consist of (i.) primibrachs, IBr; (ii.) secundibrachs or distichals, IIBr; (iii.) fixed pinnules. By "fixed" one means that the ossicles in each longitudinal series are attached not merely to one another by their upper and lower margins, but also to the ossicles of adjacent series by their lateral margins, thus forming the cup. The precise limits of fixation are not very easy to determine in the fossil state: for instance, the distal extremities of the earlier pinnules were undoubtedly free, although their proximal portions were firmly united laterally to the distichals or to other pinnules; but the exact point at which lateral union ceased cannot be determined, since, even above the limits of strict lateral sutures, the pinnules may have been laterally united by a membrane. The same uncertainty prevents us from saying at what level the arms became free; but we may say somewhere about the 8th and 9th distichal, IIBr$_9$.

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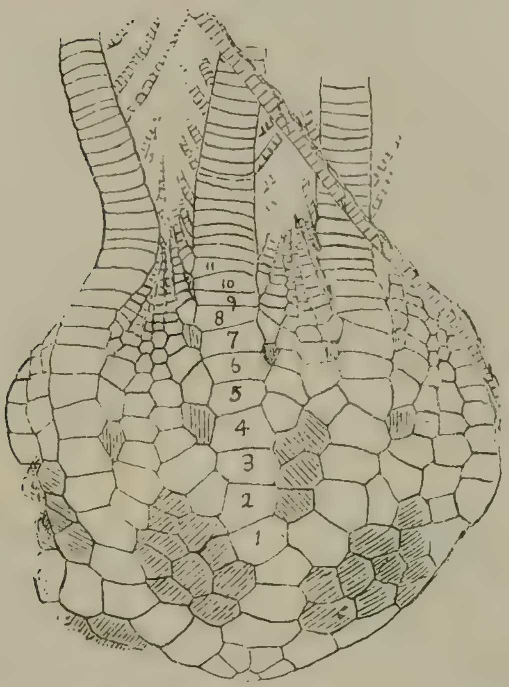
[1] "The Text-book Writer among the Echinoderms," Natural Science, vol. vi. pp. 415–423 (1895).

The **primibrachs** ("radials of the first order" in part, or "costals," of some writers) are two in number (see figs. 4 and 5). IBr$_1$ is hexagonal, resting by its lower edge on the feebly concave upper margin of the radial, supporting IBr$_2$ on its upper margin, and abutting laterally on two interbrachials on either side. It is slightly less wide than the radial, but about the same height. IBr$_2$ is axillary (IAx) and pentagonal, having on rare occasions an irregularity in the lateral margin, owing to the abutment thereon of more than one interbrachial.

The **fixed secundibrachs** (or fixed distichals) may, as aforesaid, be reckoned at about 8. They are fixed by means of interbrachials, fixed pinnules, and interdistichals. Owing to the origin from some of them of the fixed pinnules, they have a slightly irregular, zigzag arrangement, and those that bear pinnules have somewhat the aspect of axillaries. The law of their pinnulation, in both right and left branches of each arm, may be stated thus: IIBr$_1$, none; IIBr$_2$, outer; IIBr$_3$, none; IIBr$_4$, inner; IIBr$_5$, outer; IIBr$_6$, none; IIBr$_7$, inner; IIBr$_8$, outer; IIBr$_9$, none. This, at least, is the arrangement I have found in eight specimens out of ten, *e. g.* specimens γ, *d*, *e*, *f*, *g*, *l* (figs. 4, 5, 10). One of the ten specimens, viz. *b* (fig. 6), varies thus: IIBr$_6$, inner; IIBr$_7$, none; IIBr$_8$, outer; IIBr$_9$, inner. The remaining one, viz. *p* (fig. 7), varies thus: IIBr$_5$, none; IIBr$_6$, outer; IIBr$_7$, inner; IIBr$_8$, none; IIBr$_9$, outer. In both these cases the regular alternation of pinnules remains. It appears that all the rays of any individual vary, if they vary, according to the same plan.

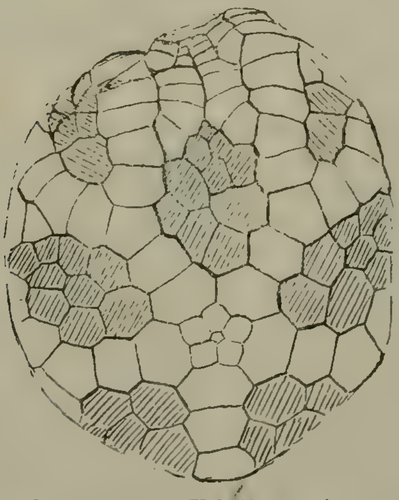
The above results were gained from an examination of actual specimens in the British Museum: it is instructive to compare them with the published figures. Grinnell's (2) figures 1 and 2 (my fig. 1) agree with the law so far as the portions in question are preserved. Both of Meek's (3) figures (my fig. 2) agree with it in every particular. Prof. Clark's (8) "Diagram showing the structural arrangement of the plates in the test" agrees with it. Clark's pl. i. fig. 1*a* (Pl. LVI.) shows the following arrangement in two branches:—IIBr$_5$, outer; IIBr$_6$, none; IIBr$_7$, outer. Not

Fig. 4.



Uintacrinus socialis, Brit. Mus. E 6328, γ. In this, as in figs. 5–12, the plates of the apical and radial systems are left white, the fixed distichals being numbered, and the supplementary plates are shaded as follows:—interbrachials, from right to left; interdistichals, from left to right; interpinnulars, vertically. An arm-fragment of another individual lies athwart the upper part of the portion drawn. Natural size.

Fig. 5.



Uintacrinus socialis, Brit. Mus. E 6527, *e*. A cup seen from below, shaded as in fig. 4. Natural size.

3

only do the two other branches agree with the law, but this arrangement violates the fundamental law of alternation of pinnules, so that I have little doubt the figure is incorrect. Clark's pl. i. fig. 1*c* (Pl. LVI.) agrees with the law except for the fact that IIBr$_9$ in the right-hand branch bears an inner pinnule, while in the left-hand branch it bears none. I have little doubt that this pinnule is incorrect. It is not merely because they are inconsistent with my own observations that I cast doubt on Prof. Clark's figures; but because they are inconsistent, each in itself, each with his other figures, and each with his own statements on p. 23. There is also internal evidence to show that Clark's fig. 1*a* of pl. i. is drawn from the same specimen as Meek's fig. B. If Meek is, as there is reason to believe, correct, then Clark is wrong. It is only fair to Prof. Clark to remember that the drawings here criticized were made by Mr. C. R. Keyes, whose work is usually trustworthy, and whose acquaintance with fossil crinoids is considerable. Mr. B. H. Hill's (9) diagram shows the following arrangement, so far as I can decipher his rather peculiar mode of representation:—IIBr$_1$, none; IIBr$_2$, outer; IIBr$_3$, inner; IIBr$_4$, outer; IIBr$_5$, inner; IIBr$_6$, outer; IIBr$_7$, inner; IIBr$_8$, outer; IIBr$_9$, inner. Now this is so absolutely inconsistent with the law, with the type-specimens, with known variations, and with the general structure of *U. socialis*, that it can only be supposed either that Mr. Hill's diagram is hopelessly incorrect, which I should be sorry to think, or that he has unwittingly figured a new species, which I find it hard to believe, especially as Prof. Williston (9) shows himself fully alive to the possibility of there being more than one American species, and would have noted the fact quickly enough.

Fig. 6.

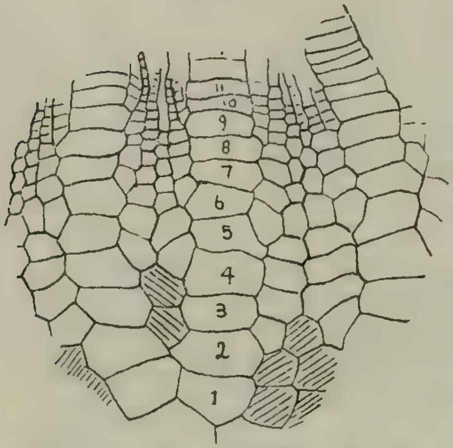


Fig. 7.

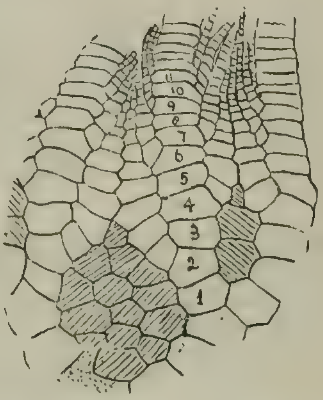


Fig. 6.—*Uintacrinus socialis*, part of Brit. Mus. E 6527, *b*, showing fixed distichals and pinnules. Natural size.

Fig. 7.—*Uintacrinus socialis*, part of Brit. Mus. E 6527, *p*, showing fixed distichals and pinnules, interbrachials, and interdistichals. Natural size.

Here, moreover, it is to be noticed that the law stated above applies equally to *U. westfalicus* (fig. 3), and therefore probably is the law for the whole genus.

It is unnecessary to describe the fixed secundibrachs in detail. They are flat, thin plates, with no trace of any axial canal, either in section, or superficially in the form of an axial ridge. They are about the same width as the immediately succeeding free brachials, but are much higher. In the latter respect, however, no line of demarcation can be drawn between fixed and free, since the change, though rapid, is not sudden.

The **fixed pinnules** arising from the fixed secundibrachs unite with one another and with the interdistichals (or interaxillary) and interbrachial plates to form the interdistichal and interbrachial (or interradial) areas of the dorsal cup. Each interbrachial area of an adult contains 3 pinnules on either side; and each interdistichal area contains 2 pinnules on either side (fig. 8). But only the proximal portions of the pinnules are fixed; the distal portions must have been freely movable and quite independent. The amount of fixation, and the number of pinnules involved, increase with age. A young individual, viz. *q* (fig. 9), shows only two pairs of pinnules in an interbrachial area; and the proximal of these appears to have only 5 ossicles fixed or modified by fixation, whereas an older individual, viz. *d* (fig. 10), clearly shows 9 in that state. In old individuals, even a fourth pair of pinnules may have been involved in the interbrachial area. The proximal fixed ossicles of these pinnules are large flat plates, both wider and higher than the succeeding free ossicles. They show no trace of any axial canal in the proximal region. The flattened plates of the fixed portions of the pinnules do not form horizontal rows across the areas, but alternate with one another, assuming a hexagonal outline.

Fig. 8.

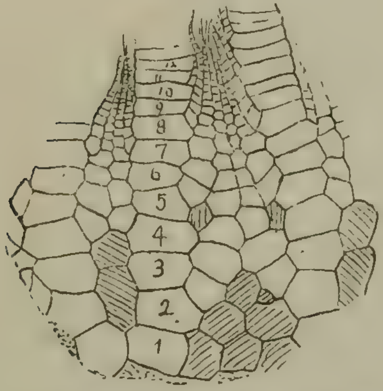


Fig. 9.

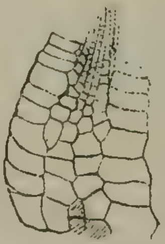


Fig. 8.—*Uintacrinus socialis*, part of Brit. Mus. E 6527, *f*, showing fixed distichals and pinnules, interdistichals, and interpinnulars.

Fig. 9.—Fixed pinnules of ditto from Brit. Mus. E 6527, *q*. Both figures natural size.

Schlueter (4) says (p. 58), with reference to the corresponding structures in *U. westfalicus*—"If one were possibly inclined to regard as side-arms, or indeed as pinnules, those rows of plates that . . . lie between the arms and the arm-branches, this would be forbidden by the constitution of the plates, since they possess neither a central canal nor a ventral groove, and are united to one another by simple sutures." This argument, though adopted by Neumayr (6), is one I am unable to accept. The absence of a central or axial canal is nothing, since there is none in the arms of many Palæozoic crinoids: it is, however, a statement that I have been unable to verify in *U. socialis* so far as the free distal ends of the fixed pinnules are concerned. It is abundantly clear that the free ossicles in the pinnules are of the same character, and are united in the same way, as the ossicles of the subsequent free pinnules. It has also been shown that the fixation of the pinnules is a gradual process. There is therefore no reason to suppose that the fixed pinnules are anything else than pinnules whose bases have become partially fixed, an occurrence by no means rare in other genera.

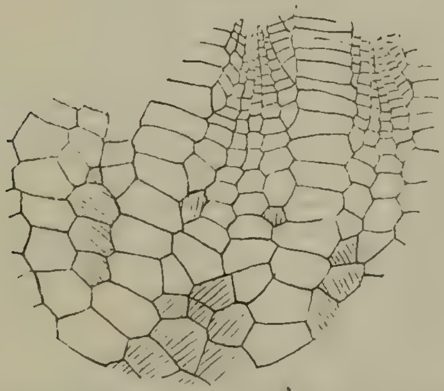
The **supplementary plates** are of three kinds: interbrachials, interdistichals, and interpinnulars. They are all thin flat plates, and vary considerably in shape and even in number.

The **interbrachials** vary in number from 7 (*fide* B. H. Hill, 9) or 8 (*fide* Clark, 8) to 12, e.g. *p* (fig. 7). In the specimens examined by me, 10 appears to be the most usual number, e.g. γ, ϵ, *e* (figs. 4, 5), and I have never seen fewer than 9. In each interradius these plates all lie above the two adjacent radials, between the fixed primibrachs and opposing fixed secundibrachs 1 and 2, and below the 1st and 2nd ossicles of the proximal, outer or interradiad, fixed pinnules. Clark says: "The arrangement of the plates does not vary; seven in an oval band enclose the 8th, or 8th and 9th, according to the number of interradials." This may be accepted as the simplest type of arrangement; but there is considerably more variation than admitted by Clark. The only stable plate is the proximal one, which rests on the upper lateral margin of two adjacent radials, and abuts laterally on the two IBr_1. Its upper margin supports the two succeeding interbrachials, but may also support the central interbrachial between them. To describe the shapes and positions of all the other interbrachials would, considering their variation, be waste of time. It is only necessary to point out that, in the large majority of the specimens before me, e.g. γ, *e*, *d*, *p* (figs. 4, 5, 10, 7), there is a single plate lying between the two proximal pinnules and the two subjacent interbrachials, and separated by those two interbrachials from the central interbrachial. This distal plate is not shown by Meek (3), or Clark, or Hill; but it can be seen in Grinnell's (2) fig. 1, although there it rests on a single interbrachial, and not on two as is usual. The particular arrangement of interbrachials figured by Meek and by Clark is unrepresented among the specimens in the British Museum; but there is no reason to doubt the accuracy of the figures. Were it not for the fact that Mr. Hill's diagram has already woefully failed us, one would not doubt it any more than Clark's; but till Mr. Hill has explained how the various plates of his analysis can be fitted together, his drawing must inevitably be neglected.

Despite the considerable variation among the interbrachials, there is no evidence to show that in a single individual any one of the interradii was so different from the others as to suggest its being an anal interradius.

The **interdistichals** have been described by all previous writers as two in number. Certainly this number preponderates; but 20 specimens in the British Museum, of which 28 interdistichal areas can be examined, show 2 interdistichals in 10 areas, e.g. *b*, *f* (figs. 6, 8), 3 in 6 areas, e.g. *p* (fig. 7), 4 in 6 areas, e.g. γ, *l* (fig. 4), 4 or 5 in 1 area, 5 in 4 areas, e.g. *d*, *k*, *g* (figs. 10, 11), and 8 in 1 area, viz. in *α* (fig. 12). The interdistichals are surrounded by $\overline{\text{IIBr}}_{1, 2, 3, 4}$ and by one or two ossicles of the proximal radiad pinnules. The proximal interdistichal is usually heptagonal, and abuts on $\overline{\text{IIBr}}_{1, 2, \& 3}$ and on the succeeding interdistichal. It may, however, not reach so high as IIBr_3, and it may not sink

Fig. 10.



Uintacrinus socialis, part of Brit. Mus. E 6527, *d*, showing fixed distichals and pinnules, interbrachials, interdistichals, and interpinnulars. Natural size.

Fig. 11.

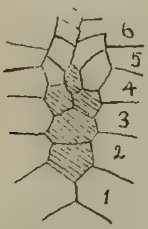
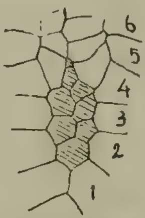


Fig. 12.



Uintacrinus socialis, interdistichal areas of Brit. Mus. E 6527, *k* (fig. 11), and E 6528, *α* (fig. 12). Natural size.

so low as $IIBr_1$. The succeeding interdistichal usually stretches across the interdistichal area, but it may be split longitudinally in two. Also it may be succeeded by more interdistichals, from 1 to 5. The number of interdistichals is not necessarily constant in the interdistichal areas of one individual. Considering this extensive variation, it is a little odd that it should not have been noticed by any of the American writers. Similar variation is not known in the unique specimen of *U. westfalicus,* which in this portion of its anatomy agrees with the normal *U. socialis.*

The interpinnulars are small plates that are often intercalated in the spaces between the proximal portions of the fixed pinnules and the intervening $\overline{IIBr}$. There is usually only one interpinnular between two adjacent pinnules, but sometimes there are two. An interpinnular on one side of an area has usually a corresponding interpinnular on the other side. The interpinnulars are quite common: I have seen them in about half of the specimens under examination, e. g. γ, ϵ, *d*, *f*, *g*, *k*, *l* (figs. 4, 5, 8, 10, 11), and it is a little curious that they are neither figured nor mentioned by any previous writers.

We have seen that the fixed pinnules probably arose from free pinnules becoming involved in the construction of the cup. We may inquire now as to the origin of the interbrachials and interdistichals. Are they derived in whole or part from pinnules, or from the tegmen; or are they mere supplementary plates? The variation in number might show that they are degenerate pinnular elements; but it is equally consonant with the theory of their supplemental origin. There is the very slightest trace of any linear arrangement, and in such rare cases as might plausibly be imagined to represent a degenerate pinnule, such an assumption would upset the regular sequence of pinnulation; so that one cannot adopt this view without further proof. I can distinguish no difference in this respect between young and old individuals. The constancy of the proximal interbrachial might lead one to regard it as a primitive tegminal element, since an interradially situate plate of the tegmen is often conspicuous in just such a position. But the proximal interdistichal, which can scarcely be a primitive tegminal element, is nearly as constant. The presence of interpinnulars, which are undoubtedly intercalated, supplementary plates, show how all these plates may have arisen. Considered as supplementary plates, the interbrachials may primitively belong to either the cup or the tegmen; one can regard all interbrachial plates as portions of the tegmen that have become included in the dorsal cup.

The general relations of all the component elements and areas of the dorsal cup to one another are as follows:—The fixed primibrachs and secundibrachs form slightly raised ridges, more prominent distalwards. The interbrachial areas, including interbrachials, fixed pinnules, and interpinnulars, are slightly depressed at the sides, but form a slightly elevated shield-like area. The interdistichal areas are depressed. These points are more obvious to touch than to sight. Each plate is slightly convex, and shows no traces of ornament or of radiate structure. Clark (8) describes the sutures between the cup-plates as "generally slightly channelled"; there are in the British Museum specimens a few obscure indications of irregular vertical groovings in the sides of the plates, which are no doubt the channellings to which Clark alludes. The number and thinness of the plates in the cup would be enough to give it the flexibility which it clearly possessed: hence elaborate sutures, as in *Marsupites* or in some *Platycrini*, were unnecessary.

The **arm-branches** are the free continuations of the fixed secundibrachs or distichal series, and are therefore 10 in number. They are composed of brachials and pinnules.

As to the length of the arm-branches, Grinnell (2) said "it seems probable that in life the spread of the outstretched arms may have been two feet or more." In the words of Meek (3), "Mr. Grinnell thinks they may have attained a length of not less than one foot." Both Clark (8) and Hill (9) quote Grinnell as saying that the arms reached 2 feet in length, which he did not say. The longest arm-fragment yet measured is that which Hill "traced for seventeen inches," but it is not stated whether this was traced up to the dorsal cup or no. The following measurements are from specimens in the British Museum:—

Description of portion measured.	Length of fragment.	Width of Brachials in mm.	Height of Brachials in mm.
Large specimen, beginning at IIBr$_8$	19·0 cm.	7·0 to 4·0	1·4, 1·45, 1·2
Smaller individual, ditto	23·5 cm.	6·75 to 2·5	1·36, 1·2, ·95
Isolated fragment	22·0 cm.	3·2 to 2·5	1·4, 1·2
" "	18·0 cm.	2·5 to 2·0	1·0, ·95
" "	23·5 cm.	2·5 to 2·0	1·25, 1·1
" "	13·8 cm.	2·0 to 1·5	·9, ·85
Finials	3·5 cm.	1·0 to ·8	·65

Making allowances for some of these examples belonging to youthful individuals, we note that the rate of tapering is very gradual, that it is rapid in the immediately proximal portion of the arm-branch, but becomes much less distalwards. Similarly the decrease in height of the brachials is very gradual; it actually seems to increase at first in some cases, and then to lessen slowly. Let us allow 10 cm. in each arm-branch for the proximal irregularities; then, taking it that the width has to decrease from 4 mm. to 8 mm., and that the rate of decrease is ·5 mm. in 15 cm. (which is rather more than the average), we conclude that the total length must be 10 cm. + 96 cm. = 106 cm. Similarly, taking it that the height of a brachial has to decrease from 1·4 mm. to ·65 mm. and that the rate of decrease is, at the utmost, ·2 mm. in 20 cm., then we conclude that the total length was not less than 10 cm. + 80 cm. = 90 cm. This latter method is not quite so reliable as the former, since measurements are more difficult to make, and since syzygies interfere with the striking of a correct average. But we are certainly justified in concluding that in an adult the length of a free arm-branch, counting from the suture between the eighth and ninth secundibrach, was certainly not less than 100 cm., or about 3 feet 3½ inches, and that it contained fully 1000 brachials. Consequently, to adapt the words of the first describer of this crinoid, "it seems probable that in life the spread of the outstretched arms may have been" 6 feet 9 inches "or more." The longest arms in other crinoids are about 26 cm., or 10¼ inches, in *Extracrinus* from Boll, and about 22 cm., or a little under 9 inches, in *Scaphiocrinus swallowi* from the Carboniferous of North America. Enormous though the length is, as compared with that attained by other crinoids, the drawing of a reconstructed individual shows that it is by no means excessive when compared with the size of the dorsal cup (Plate LV.).

The arm-branches are found stretched along ventralwards, or opened at right angles to the cup, or bent back aborally, sometimes straight, sometimes curved, sometimes coiled round in a loop of half an inch or less in diameter. It is clear that they had great power of motion in all directions; and this is borne out by the structure of the brachials.

The **brachials** are usually compressed along different axes, according as they lie on the slab, so that it is hard to estimate their exact shape. It appears that the more proximal brachials were wider than deep (Pl. LIV. figs. 6, 8), while the more distal ones were deeper than wide (Pl. LIV. figs. 2, 5), also that the more distal brachials were higher in proportion than the more proximal ones. Owing to the pinnulation, the sutures between the brachials are not parallel, but slope alternately right and left. This feature, which was marked in the fixed brachials, is barely perceptible in the more proximal free brachials, but increases distalwards. The more proximal brachials are smoothly and regularly rounded; but the more distal ones become excavate and develop a clearly marked ridge, or cornice, on their distal margins, which ridge is more intense on the side towards the pinnule (Pl. LIV. fig. 11).

The ventral groove is V-shaped. In the more proximal brachials it is wide and enclosed by convexly curved sides (Pl. LIV. fig. 6); in the more distal brachials it becomes gradually deeper and is enclosed by straight sides (Pl. LIV. figs. 2, 5). Covering plates to the ventral groove have not been observed; probably they were small and lay, separate from one another, in a membrane, and so would not readily be preserved *in situ*.

The **joints** between the brachials are of two kinds: perforate articulation, and syzygial suture.

The **perforate articulation** is represented in figs. 2, 3, 6, 7, 8, 9, 10 of Pl. LIV. The axial canal perforates the brachial at a very short distance from the bottom of the ventral groove. Two parallel ridges run across the under or proximal surface of the brachial, coalescing around the axial canal. These ridges fit into a corresponding groove on the upper surface of the subjacent brachial, which groove itself appears to be bounded by slight ridges. No specimen shows a single fulcral ridge, with median perforation, such as is shown in Clark's (8) pl. ii. fig. 1 *e*. Owing to the state of preservation, and to the difficulty of seeing more than one side of any brachial, one cannot certainly distinguish between the proximal and distal surfaces, except when there is other evidence available. The direction of the ridges is not straight across the width of the brachial, but is diagonal; and I think that on the distal surface the end towards the pinnule-bearing side is moved dorsalwards, as is the case in *Pentacrinus*. Since the pinnules alternate from right to left, it follows that the direction of the diagonals must also alternate; so that, as is actually the case, the successive diagonals must lie almost, or quite, at right angles to one another (compare figs. 2 & 10 of Pl. LIV.). This skewing of the ridges is quite obvious and well-marked over the greater part of the arm; but in the more proximal region, where the brachials are still wide, and have rounded sides to the ventral groove, this skewing is not so marked (Pl. LIV. fig. 8). A most careful search has, however, failed to disclose a single brachial with a symmetry like that of Clark's (8) pl. ii. fig. 1 *e*, although one can find in the proximal region brachials more like Schlueter's (4) pl. iv. fig. 5, *a*, *b*, which is still asymmetrical (see Pl. LIV. fig. 6). Sometimes half the ridge appears to be more skewed than the other half, as in Pl. LIV. fig. 8. The position of the muscles and ligaments is not easy to determine. There was, no doubt, a bundle of ligament-fibres on the outer or dorsal side of the ridge; and according as the ridge was twisted to left or right, the area of attachment for these fibres must have moved alternately right and left. There is a faint depression over this part of the joint-surface. One would naturally assume a bundle of muscle-fibres in the area on either side of the ventral groove, and ventrad of the ridge; but when the ridge is skewed this area becomes large on one side, and almost non-existent on the other. In the larger area one can easily make out a depression for the attachment of the fibres; while in the smaller area one can often distinguish a strong elongate groove, parallel with the fulcral ridge, and this groove must represent the concentrated area of attachment of the fibres of this side.

It is clear that this skewing of the fulcral ridges must have given the arms great power of motion, not merely up and down as in *Antedon*, but from side to side. In this respect the arrangement is analogous to that in the stem of the Bourgueticrinidæ, and, in a less degree, to the twisted stem of the Platycrinidæ. The advantage which such an arrangement of arm-joints confers on a free-swimming crinoid is obvious, since the animal is thereby enabled to progress more rapidly in any desired direction.

The origin of this skewing may be connected with the pinnulation of the arm. Each pinnule-bearing brachial is essentially an axillary. An axillary normally has two joint-surfaces and two fulcral ridges at its distal end; and these ridges are not parallel to the transverse axis of the ossicle, but converge dorsalwards. As one branch diminishes and becomes a pinnule, the joint-surface on that side also diminishes, while the other joint-surface comes to occupy the greater width of the ossicle, and its ridge becomes parallel with the transverse axis of the ossicle. We may suppose that in *Uintacrinus* the slanting of the ridge was maintained, though the ossicle underwent the usual changes. It is of course the case that in the pinnulate arms of other crinoids, e. g. *Pentacrinus* and *Metacrinus*, there is an asymmetry of the joint-surface, due to pinnulation, as was long ago well described by Johannes Müller[1]; but I can find no instance of a skewing so marked as in *Uintacrinus*.

The **syzygies** are of the type common in the *Antedonidæ* (Pl. LIV. figs. 4, 5). From the periphery of the brachial clearly defined ridges converge to the axial canal. All the ridges do not reach the axial canal, but only alternate ones, or sometimes one in three. The ridges near the medio-dorsal line are the more marked. The space between the ridges seems to be wider than the ridges themselves; nevertheless I have been unable to distinguish between the upper and lower surfaces of the joint. Sometimes the ridges are slightly channelled. The figure given by Clark (8) seems incorrect in being so symmetrical, and in the meeting of all the ridges around the axial canal. Schlueter's (4) figures of syzygial surfaces in *U. westfalicus* present a very different appearance, in that they show narrow grooves rather than ridges, which grooves have the same arrangement as the ridges in *U. socialis*. Both Schlueter's figures represent the upper surfaces of hypozygals, and it might be supposed that the under surfaces of the epizygals were ridged. But, in any case, it is odd that there should be no such grooved appearance in any hypozygals of *U. socialis*.

In describing the distribution of syzygies in an arm, it is the custom to reckon as one ossicle the two ossicles that are united by such a joint, and to transfer the term syzygy from the union to the pair of united ossicles. But "to my mind . . . it is a custom more honoured in the breach than the observance," and in another place[2] I have given reasons for adopting a method more consistent with both correct terminology and morphological ideas.

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[1] "Ueber den Bau des *Pentacrinus caput medusæ*," Phys. Abh. Akad. Wiss. Berlin, Jahrg. 1841. See p. 213 and pl. ii. figs. 4 & 13 (1843).

[2] "The Term 'Syzygy' in the Description of Crinoids," Zool. Anzeig. vol. xix. pp. 57–61 (Feb. 3, 1896.)

In the present paper, at any rate, each brachial is treated as a unit, and the term syzygy is confined to its original meaning, viz., an immovable sutural union between two ossicles.

In the fixed region of the arm we may assume that the distribution of the syzygies is governed by the law of pinnulation above stated, that is to say, the non-pinnulate secundibrachs are taken to be hypozygals. For *U. westfalicus* this assumption is definitely confirmed by the observations of Schlueter (4), which show that the ossicles in question have a radiate upper joint-surface. In *U. socialis* this has not been seen, but in external appearance the supposed syzygial sutures are closer and finer than the rest. For $\mathrm{IIBr}_{1\text{–}50}$ the distribution of the syzygies has been worked out in 16 arms belonging to 5 individuals, and the results are given in the accompanying diagrams (pages 992 & 993). It appears from these that the syzygial sutures occur at successive average intervals of 3, 4, 4, 5, 7, 5, 7, and 8 sutures. The persistent syzygial nature of the 26th suture is remarkable, and is one of those facts that would be obscured by the usual method of counting. The regularity of the syzygies seems to decrease in the more distal regions; that is to say, although in a single arm the intervals are fairly constant, yet there is considerable difference between individuals, possibly between the several arms of one individual. There is some reason to suppose that the interval between the syzygies is usually less in the proximal portion of the arm than it is in the median portion, but the evidence is insufficient. A long arm-fragment of medium width has syzygies at intervals of 10–15 sutures; but another much narrower arm-fragment of over 130 brachials has syzygies at intervals of 5–8 sutures, the usual intervals being 6 and 7.

The large number of the syzygies and their regular distribution throughout the whole length of the arms, doubtless bear some relation to the animal's mode of life. It is natural to suppose that syzygies have been developed to afford points of easy fracture, such as could never be presented by the muscular and ligamentary articulations. Thus, when an arm is entangled or is caught by some enemy, the crinoid merely breaks it off and swims or crawls away, happy in the knowledge that a new arm will soon grow from the stump. This explanation has been confirmed by the experiments of J. Walther on *Antedon rosacea*[1]. A *Uintacrinus*, with its sociable disposition, must often have found its long flexible arms inextricably interlaced with those of its fellows. Only by the syzygies can it have escaped from the too close embrace.

In the fixed portion of the arm the hypozygals and epizygals do not materially differ in height or appearance from the other fixed brachials. It would be preposterous to count $\overline{\mathrm{IIBr}}_{3\,\&\,4}$, $\overline{\mathrm{IIBr}}_{6\,\&\,7}$, or even $\mathrm{IIBr}_{9\,\&\,10}$, as single morphological units, as would be done on the usual system of counting. After this, the hypozygals and

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[1] "Untersuchungen ueber den Bau der Crinoiden," Palæontographica, xxxii. p. 180. (Oct. 1886.)

TABLE showing the position of Syzygies in 16 arm-branches of 5 individuals of *Uintacrinus socialis*. Each horizontal line represents an arm-branch, of which the proximal 50 secundibrachs are numbered; a black line unites those that form a syzygial pair.

SPECIMEN	RAY	ARM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
f	L.	l.			—	—		—	—		—	—						—	—					—	—				—	—				—	—						—	—										
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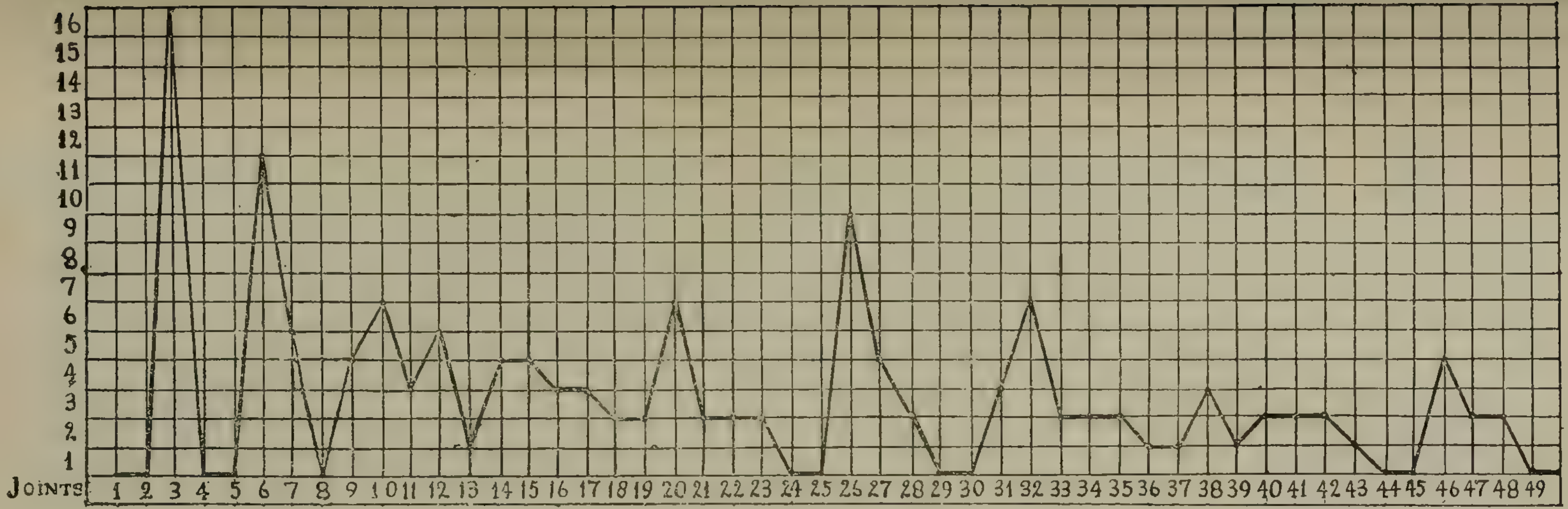

CHART showing the distributional curve of the Syzygies in the first 50 joints of the distichal arm of *Uintacrinus socialis.* The horizontal numbers (1–49) are on the joints, not on the ossicles; the vertical numbers (1–16) represent individual arm-branches.

epizygals gradually diminish slightly in height, till they become about two-thirds the height of an ordinary brachial, rarely less (Pl. LIV. fig. 11). It is often very hard to decide whether two adjacent ossicles are united by syzygy or no, so little do they differ in outward appearance from the neighbouring brachials. Occasionally the syzygial joint is a little less curved, as though there were some attempt at dovetailing, a suggestion of the structure in *Pentacrinus naresianus* and *P. blakei*.

The **pinnules.**—The law of pinnulation for the fixed pinnules has been discussed fully. That for the free brachials is the same as obtains in most modern crinoids: each ossicle, except the hypozygals, bears a pinnule, and the pinnules are on the right and left sides alternately. Viewed from the side of the arm, as in fig. 11 of Pl. LIV., the proximal ossicle of each pinnule appears sub-crescentic in outline, and lies in a corresponding semicircular notch, excavated in the upper corner of its brachial. The lower corner of the succeeding brachial is also slightly excavated, and the pinnulars fit closely up against it. In the case of a syzygy, the notch for the proximal pinnular may extend a little below the epizygal and include a small portion of the hypozygal. When seen from the back of the pinnule, each pinnular, with the exception of the proximal one, has its upper and lower margin parallel to each other; but seen from the side each ossicle has a sub-triangular outline, the base of the triangle being dorsal. This is seen to a slight extent in fig. 13 of Pl. LIV. In other words, each pinnular decreases in thickness towards the ventral side of the pinnule; and this enables the pinnule to curl upwards over the ventral groove of the arm. This feature is more marked in the proximal region of the pinnule than in the distal. As is usually the case with both arms and pinnules in the Crinoidea, the proximal ossicles of each pinnule are wider than high, while the distal ones are higher than wide. There are at least 30 ossicles in each pinnule; in some, 40 can be counted. In some cases the pinnulars show a concavity of the sides like that in the brachials (Pl. LIV. fig. 13).

On the ventral side each pinnule has a shallow groove (Pl. LIV. fig. 14). This was probably roofed by covering-plates, though none are preserved in the fossil. On either side of the groove, and at right angles to it, is a slight depression or channel in each pinnular. These may have been for the passage of the tentacles, or they may represent articular depressions for the covering-plates such as I have figured for *Cyathocrinus acinotubus* and *C. ramosus*[1]. The objection to the latter interpretation is that the covering-plates must in that case have been rather too large and solid to have so entirely disappeared.

The articular surfaces of the pinnulars (Pl. LIV. fig. 12) appear to show an axial canal separate from the ventral groove, and on either side thereof a depression for attachment of ligament, *i. e.* a bifascial articulation; but there is no defined ridge, and of course no such skewing from right to left as in the brachials. The pinnules gradually decrease in size towards the distal end of the arm, and eventually become of exceeding tenuity. Since they are rarely preserved or traceable for their whole length, measurements are difficult to make. A brachial 3·0 mm. wide bears a pinnule of which the proximal ossicle is 1·0 mm. wide. A brachial 2·5 mm. wide bears a pinnule of which the proximal ossicle is ·8 mm. wide, and the total length more than 11·5 mm. A brachial 2·0 mm. wide bears a pinnule of which the proximal ossicle is about ·5 mm. wide, and the total length fully 16·5 mm.

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[1] "Crinoidea of Gotland," i. figs. 208 & 255, in Svensk. Vet.-Akad. Handl. xxv. 2 (1893).

3. The Relations of Uintacrinus.

As already stated, there are no forms with which direct comparison is obvious. The discovery of the ancestry of *Uintacrinus* must therefore be a long process of induction. In prosecuting such an inquiry, the first step is to clear away secondary and accidental characters, so as, in any comparison, to utilize only those that are essential. It is, for instance, futile to lay any stress on the fact that *Uintacrinus* is an unstalked crinoid, and for that reason to compare it with its contemporary *Marsupites*. Worse still to follow H. A. Nicholson and P. H. Carpenter (7), and to place the two genera in a single family, though their organization differs in almost every other respect. As well place it with *Saccocoma*, or with *Agassizocrinus*, or any other stalkless crinoid. Surely the argument is absolutely the reverse. Features in which unstalked and free-swimming crinoids agree with one another are, it is probable, features due to similarity of environment rather than similarity of descent. The resemblance is physiological, not morphological. In short, one infers that such features are secondary, and not essential. They are the ones to be cleared away.

Let us consider the general and **common characters of unstalked crinoids.** All agree in the absence of a stem in the adult; but, when further compared, they are soon seen to fall into three distinct groups. First, the group in which a portion of the stem remains, becoming modified into a cirrus-bearing centrodorsal, as in *Antedon*, *Eudiocrinus*, and *Thaumatocrinus*. These forms anchor themselves by their cirri, and though capable of crawling, climbing, and swimming, do not often exercise their faculty of locomotion. Secondly, the group in which either a portion of remaining stem, or the lower part of the cup (*i. e.* basals or infrabasals), becomes solidified, usually by additional deposition of stereom, into a knob, which, one may suppose, serves as ballast or as a sea-anchor; such forms are *Agassizocrinus*, *Edriocrinus*, and *Millericrinus pratti*. Both of these groups have a small calycal cavity with thick walls, and there can be little doubt but that all are attached by a stem in the earlier stages of ontogeny. The third group, comprising *Marsupites*, *Saccocoma*, and *Uintacrinus*, has no trace of a stem or of any anchoring structure, but is in all respects adapted for free locomotion; the calycal cavity is large in proportion to the thickness of the arms, and is enclosed by thin flexible walls. Of these three genera, *Saccocoma* is the most specialized; as Otto Jaekel concludes in his detailed and interesting account, "The totality of organization and the mode of occurrence of the Saccocomidæ indicate that they were pelagic animals, and that, as such, they not merely lived in swarms, but inhabited every peaceful basin of the Solenhofen sea in enormous numbers" (Zeitschr. deutsch. geol. Gesell. xliv. p. 689, 1893). *Marsupites* also was perhaps pelagic; the plates of its skeleton are, as I intend to show in another paper, of very light construction and with flexible unions; the specific gravity of the whole animal must have been light and perhaps still further lightened, as Jaekel suggests for *Saccocoma*, by "a slight development of gas within the body." *Uintacrinus*, with its large calyx, its thin flexible test, its extraordinarily long and movable arms, appears likewise to possess the characters of a pelagic organism; and so far as the argument from mode of occurrence is of any value in the case of *Saccocoma*, it is just as applicable in the case of *Uintacrinus*, or at all events *U. socialis*, which lived in similar swarms and is buried in a similar deposit. As for *U. westfalicus*, its gregariousness may be open to dispute, but it is to be noted that the one specimen known occurs in association with *Marsupites*. At any rate, *Uintacrinus*, *Marsupites*, and *Saccocoma* appear to have had much the same mode of life, and to have been subject to similar environment.

Let me repeat that the word group, as used in the preceding paragraph, is of physiological and not morphological significance. It implies identity of condition but not of ancestry. Take any one of these groups, and what could be more divergent than the forms therein included? *Thaumatocrinus* is essentially so unlike *Antedon* that, had the two genera not chanced to be both furnished with a centrodorsal, not a soul could have been led to place them in a single family, or even, one would imagine, in a single order. In the second group, *Agassizocrinus* is a dicyclic Inadunate, apparently allied to *Cromyocrinus*; *Edriocrinus* is a monocyclic Inadunate of obscure, but undoubtedly very different, affinities; *Millericrinus pratti* is but a single species of a well-known genus of Pentacrinidæ, and is pseudo-monocyclic. So is it with our third group: *Saccocoma* has a cup of nothing but radials; *Marsupites* has radials, basals, and infrabasals; *Uintacrinus* has no infrabasals, but, in addition to its basals and radials, has brachials, interbrachials, interdistichals, pinnulars, and interpinnulars, all helping to compose its dorsal cup.

Admitting the essential dissimilarity of the three forms in our third, or pelagic, group, we see the sooner what are the **secondary features due to environment**, the necessary consequences of their line of evolution. They are the features in which these three dissimilar forms have come to resemble one another. The thinness of the test, the large size of the calycal cavity, the flexibility of both test and arms, are obvious points that have already been alluded to. It is also noteworthy that each of these very differently constituted cups resembles the others in one curious feature, namely, the presence of a central, pentagonal, apical plate. One may say, if one chooses, that in *Saccocoma* this represents the fused basals, and in *Uintacrinus* the fused infrabasals; but in *Marsupites* it must be something else. Or one may say that in each case it is the same element, be it the proximal stem-ossicle (which some erroneously call "centrodorsal"), or the distal stem-ossicle (which some, seeking an homology, have called "dorso-central"), or perhaps a new plate altogether, a simple supplementary plate developed to fill up the gap left by the disappearance of the stem. One might argue for ever: there is no evidence. The one obvious fact is that such a central plate is found in three very different forms, all of which were free-swimming, and unlike all other crinoids in showing absolutely no trace of a stem. It is therefore not safe to ascribe to the central plate any morphological significance, or to give it any name other than "centrale."

The large size of the body is produced in *Marsupites*, and still more in *Saccocoma*, by the largeness of the plates; in *Uintacrinus* it is produced by the incorporation of many brachials, interbrachials, &c. into the dorsal cup. The large size being probably a secondary character, it is not fair to argue that the ancestors of *Uintacrinus* had so many plates in the dorsal cup; although we must infer that they were forms that had a tendency to this mode of enlargement of the cup.

The **essentials of structure** in *Uintacrinus* appear thus to be: 5 basals; 5 radials; 5 arms, branching once; the two primibrachs, at least, united by interbrachial; pinnules borne by secundibrachs, beginning with $IIBr_2$; a tendency for proximal pinnules to coalesce; an axial canal separated from the ventral groove of the brachials.

As claimants to provide an ancestor for *Uintacrinus* the **Camerata**, notwithstanding the superficial resemblance in the cup of many of them to this genus, must at once be put out of court as having no separate axial canal in the arms. The flexible tegmen of *Uintacrinus* is also removed from the Camerate type. Indeed, so far as I am aware, Jaekel (**10**) is the only writer of repute that has endeavoured to find the ancestor of *Uintacrinus* in this order. The Rhodocrinidæ, however, which are the forms he fixes on, are far removed from *Uintacrinus*, in the possession of branched, biserial arms, and interradials resting on the basals.

This leaves, among Palæozoic crinoids, from which one presumes that Mesozoic crinoids are descended, the Inadunata and the Ichthyocrinacea (=Articulata, W. & Sp., Flexibilia, Zittel).

Most if not all of those palæontologists that have attempted an answer have decided in favour of the **Ichthyocrinacea**, usually pitching on *Forbesiocrinus* as their example of a similar form. Held, as it has been, by Zittel (**5** and **11**), Neumayr (**6**), Carpenter (**7**), and apparently by Schlueter (4), who, however, cleverly shirked giving a definite reply, this opinion demands respectful consideration. The opinion will be more acceptable if *Onychocrinus* be substituted for *Forbesiocrinus*. For in *Onychocrinus* one finds what does not occur in *Forbesiocrinus*, namely a differentiation of the arms into two main branches, with a tendency for the armlets to be reduced to the size and regularity of pinnules. This tendency is most obvious in the species for which R. R. Rowley[1] proposed two generic names in a single paper, viz., *Aristocrinus*, or *Callawaycrinus*, *concavus*. Considering the extreme difficulty that the most acute palæontologists have met with in distinguishing the genera *Ichthyocrinus*, *Taxocrinus*, *Forbesiocrinus*, *Onychocrinus*, and their allies, considering the impossibility of deciding such a question with the assistance of the comparatively few specimens or species in the British Museum, and considering the confused nature of the large and scattered literature, I would not, on the slight evidence offered by Mr. Rowley, venture to pass any criticism on his action other than that the name *Aristocrinus*, or "the best crinoid," is singularly inappropriate. Names and minor differences apart, we find in this group of forms many species with small and disappearing infrabasals, with interbrachials forming a flexible union between the rays, with occasional interdistichals, with the proximal primibrachs and secundibrachs broad-backed thin plates very like those of *Uintacrinus*, with an axial canal differentiated in at least the more distal brachials, with a flexible tegmen, and with flexible arms and cup; and some species with a distichal and sub-pinnulate arm-structure, and with two primibrachs in each ray. In all these features, then, there is a noteworthy resemblance; but a closer inspection will reveal many important points of difference. The species to which reference has been made have an anal area distinct in the cup, such as there is no trace of in *Uintacrinus*. This, however, might well disappear in course of evolution, especially in a free-swimming form, just as it has disappeared in *Encrinus* and in *Antedon*, although undoubtedly present in the ancestors of those two genera. It is more important to notice that the interradially situate plates of the Ichthyocrinidæ are all of them true interbrachial plates of the secondary system; they are none of them modified pinnules. Indeed the pinnules are in no case advanced to such a stage that they could coalesce as in *Uintacrinus*. The most one can say is, that in some species of *Ichthyocrinus* the brachials seem to have been united laterally. Again, there are no traces of syzygial union in the arms of the Ichthyocrinidæ. Indeed the arms are so much less differentiated, even in *Onychocrinus*, than they are in *Uintacrinus*, that if one supposes any links between the two forms, one must suppose a very long chain of them. But of this chain, not one link is known. Therefore, though I admit the force of the arguments of those eminent authorities who, with Neumayr (6), "regard it as most probable that *Uintacrinus* is a last straggler of the Ichthyocrinidæ," yet I cannot but consider the counter-arguments, here first definitely stated, as of even greater weight. One may also add the fact that none of the known Flexibilia show that predilection for a free mode of life that is so common in the order next to be considered.

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[1] "Description of a new Genus and five new Species of Fossils from the Devonian and Sub-Carboniferous Rocks of Missouri," Amer. Geol. xvi. pp. 217–223 (Oct. 1895).

Turning to the **Inadunata**, we have to choose between monocyclic and pseudo-monocyclic forms; since, had the immediate progenitors of *Uintacrinus* well developed infrabasals, one must suppose that these would have been retained and utilized to expand the walls of the cup, as in *Marsupites*.

Among **Inadunata monocyclica** choice is at the outset limited to those genera whose symmetry is not disturbed either by the transverse bisection of certain radials or by the greater development of certain other radials. From these more symmetrical forms, again, must be removed those that have simple unbranched arms, such as *Hoplocrinus*, *Hybocrinus*, *Symbathocrinus*, and *Cupressocrinus*. *Iocrinus*, with its dichotomus, non-pinnulate arms, is also out of the question; while one need hardly mention such undeveloped genera as *Gasterocoma*, *Lageniocrinus*, and *Allagecrinus*. Thus *Belemnocrinus*, if correctly placed here, is the only genus remaining; in its bifurcate, sub-pinnulate arms, richly provided with syzygies, and in the structure of its cup, it certainly presents more resemblance to *Uintacrinus* than do any of the other genera; but in its large anal tube, and in the entire absence of any plates binding together the brachials, it is still far removed from our genus.

The field of choice is now narrowed down to the **Inadunata dicyclica** and their descendants in the Mesozoic era, the **Canaliculata**. The earlier fistulate forms, with their asymmetrical anal areas, may be at once set aside; so may all genera with many-branched arms, whether pinnulate or non-pinnulate. Thus we are restricted to such genera as *Erisocrinus*, *Stemmatocrinus*, *Encrinus*, *Dadocrinus*, and some species of Pentacrinidæ. At first sight there appears mighty little resemblance between these and *Uintacrinus*; so little that no one has ever dreamed of mentioning them in this connection. Yet it is here, and here only, that we find those essentials of structure that have been proved requisite in the ancestors of *Uintacrinus*. A large number of these genera agree in the possession of 5 basals, 5 radials, two primibrachs in each radius, arms bifurcating once, bearing pinnules, and with a separate axial canal. The earlier genera have distinct infrabasals; but the later genera are pseudo-monocyclic, the infrabasals being either absorbed or hidden in the adult, and occasionally fused with one another. It has already been suggested that *Uintacrinus* was more likely to be descended from a pseudo-monocyclic than from a dicyclic ancestor. Some species of these pseudo-monocyclic genera have the primibrachs united by interbrachial plates. Schlueter (4) has referred to *Guettardicrinus*, in which the primibrachs are separated by small but well-defined interbrachials, while a few interdistichals are also present; interbrachials also occur in *Apiocrinus roissyanus* and *A. elegans*. In both these forms, however, the plates of the cup are too thick, and the arms too much branched, for us to infer any direct affinity with *Uintacrinus*. I refer to these facts merely to show the possibility of a development of interbrachials and interdistichals among the genera of the group. Similarly the Pentacrinidæ, notably *Extracrinus*, may develop interbrachials; and in *E. lepidotus*, at any rate, the proximal pinnules seem to have been laterally united, forming thin scaly plates. Moreover the whole arm-structure of *Uintacrinus* is singularly like that of the Pentacrinidæ. But we must look for a form not so highly modified, and one in which the arrangement of syzygies and pinnules does not conflict with the law of their arrangement in *Uintacrinus*. Thus, by a gradual process of elimination, we are forced back upon *Dadocrinus*, and here indeed appears to be the object of our search.

The genus **Dadocrinus**, based by H. von Meyer on *Encrinus gracilis*, von Buch, which has been investigated by Beyrich, Kunisch, Gürich, Wachsmuth and Springer, and above all by A. von Koenen[1], is admitted to be an ally of *Erisocrinus*, *Stemmatocrinus*, and *Encrinus*, and to be intermediate between them and the Pentacrinidæ and Apiocrinidæ. Whether or no it be the actual ancestor of the latter families, it at least comes as near as possible to what that ancestor must have been. It is pseudo-monocyclic, has 2 primibrachs, pinnulate arms bifurcating once, with a separate axial canal; its primibrachs are united by a number of small interbrachials which pass up into a thin-plated flexible tegmen. The arrangement of pinnules and syzygies in the proximal region of the arms is governed by the same law, and subject to the same regular exceptions, as in *Uintacrinus* (fig. 13)[2]. The proximal pinnules are larger than the others, and have flat backs and square sides, thus resembling the coadunate pinnules of *Extracrinus*. Now in all these essential points of structure, *Dadocrinus gracilis* agrees precisely with *Uintacrinus*. All that we have to suppose is a gradual exaggeration of these features and the loss of the stem. The former is a natural supposition, since, as has just been shown, much the same thing occurs in the Pentacrinidæ and Apiocrinidæ. If *Dadocrinus*, or an allied form, is the ancestor of *Pentacrinus* in one direction, of *Apiocrinus* in another direction—then why not of *Uintacrinus* in a third direction? As to the loss of the stem, it may have been by a process of gradual diminution, or in consequence of a habit of sudden separation. In favour of the former view are the instances of many species of *Pentacrinus*, which are known to move from place to place, and especially of *Millericrinus pratti*, the stem of which gradually dwindles to nothing. In favour of the latter view is the suggestive fact that in the slabs of fossil *Dadocrinus* the crown is almost always broken off from the stem either at, or immediately below, the junction of the stem with the cup; and this must have taken place as a reflex response to some stimulus rather than as the result of force, for the crowns are otherwise undisturbed, and are still in natural juxtaposition with

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[1] "Beitrag zur Kenntniss der Crinoiden des Muschelkalks," Abh. Ges. Wiss. Göttingen, xxxiv. Phys. Kl. i. pp. 1–44, pl. i. (1887), and "Ueber die Entwicklung von *Dadocrinus gracilis*, v. Buch, und *Holocrinus wagneri*, Ben., und ihre Verwandtschaft mit anderen Crinoiden," Nachrichten Ges. Wiss. Göttingen, Math.-phys. Kl. Jahrg. 1895, pp. 283–293 (pages 292, 293 being wrongly imposed), 14th Dec., 1895. In these papers references to the rest of the literature will be found.

[2] Von Koenen (*op. cit.* 1895) describes the pinnules as borne on the outer side of IIBr$_2$, on the inner side of IIBr$_4$, and thence regularly on each secundibrach, on the outer and inner sides alternately. The syzygies that are to be inferred from this arrangement agree with the plan of *Uintacrinus*. But I have found yet other arrangements, which make the resemblance still more striking. A slab in the British Museum (E 6070) enables one to trace the arrangement in several arms. The commonest type has syzygies between secundibrachs 1 & 2, 3 & 4, 6 & 7; pinnules are borne by the epizygals and by IIBr$_5$, first on the

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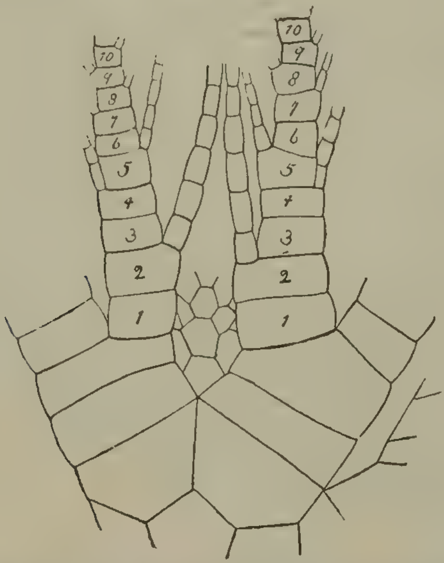
outer, then on the inner side, and so on regularly. One variation shows syzygies between secundibrachs 1 & 2, 3 & 4, 5 & 6. Another shows syzygies between secundibrachs 1 & 2, 3 & 4, 5 & 6, 8 & 9. Professor von Koenen has obliged me by examining his numerous specimens with reference to this point, and admits that such differences from his own account do occur. He is at variance with me only in considering them "anomalous;" but there is nothing really anomalous about them, for the law of alternate pinnulation is never abrogated. The only question is, which type is the most usual. The one Von Koenen finds most often, I find most seldom. Both, however, agree with *Uintacrinus* so far as they go.

Fig. 13.



Dadocrinus gracilis, portion of a specimen from Sacrau, near Gogolin in Silesia, Brit. Mus. E 6070. The drawing shows basals, radials, primibrachs, secundibrachs (or distichals), pinnules, and interbrachials. Magnified 5 diameters.

the stems[1]. Which view be ultimately accepted must depend on the evidence of intermediate stages actually found fossil, stages that shall bear the same relation to *Uintacrinus* as *Thiollierierinus* bears to *Antedon*. It is true that such links are still to seek; but the number of missing links is far fewer on this hypothesis than on any other that has hitherto been advanced.

4. SUMMARY.

This paper attempts a complete morphological description of *Uintacrinus socialis*, and a comparison of it with *U. westfalicus*. The deficiencies of previous accounts are made good, and the errors of them corrected: this is specially the case with regard to the interbrachials, interpinnulars, brachials, pinnules, and joints. The more accurate knowledge thus obtained enables a comparison with other crinoids to be based on something more than external appearances. It is thus shown that *Uintacrinus* cannot be related either to the Camerata, e. g. to *Rhodocrinus* as Jaekel has supposed, or to the Ichthyocrinidæ as maintained by Von Zittel, Neumayr, and others. It must therefore be related either to the Palæozoic Inadunata or to their Mesozoic descendants, the Canaliculata (=Articulata of Müller). Among these, a process of comparison and elimination leaves behind only the ascending evolutionary line that contains *Encrinus*, *Dadocrinus*, *Pentacrinus*, and *Apiocrinus*; and a simple inspection then enables us to fix on *Dadocrinus* as the one among all known genera that is the most nearly related to the ancestor of *Uintacrinus*.

Whether this conclusion be right or wrong, I should like to point out that it was not present to my mind when this investigation was begun, and that it has been arrived at solely by observation of a large number of facts and by simple induction from those facts. The circumstance that this conclusion differs from those of more eminent writers arises partly from the revision and increase of the facts concerning *Uintacrinus* itself, partly from the broader principles that a more accurate knowledge of the Crinoidea now enables us to apply. Knowledge cannot be too accurate or too detailed. It is not till the details have been accumulated that we can understand their meaning.

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[1] *Cf.* D. C. Danielssen, "Crinoida," Norske Nordhavs-Exped. xxi., Zoologi, pp. 11–14 (1893); also Editorial on "Autotomy in Echinoderms," Natural Science, vol. v. p. 4 (July 1894).

5. The Literature of Uintacrinus.

1. 1871. Marsh, O. C.—"On the Geology of the Eastern Uintah Mountains." Amer. Journ. Sci. (3) i. pp. 191–198. March. The reference to the new crinoid is on p. 195.
2. 1876. Grinnell, G. B.—"On a new Crinoid from the Cretaceous Formation of the West." Amer. Journ. Sci. (3) xii. pp. 81–83, iv. July.
3. 1876. Meek, F. B.—"Note on the new genus *Uintacrinus*, Grinnell." Bull. U. S. Geol. & Geog. Survey, ii. pp. 375–378. August.
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6. EXPLANATION OF THE PLATES.

PLATE LIV.

Structure of Uintacrinus socialis.

Fig. 1. The apical system of specimen *e*, in E 6327. × 3.
Fig. 2. Articular or joint surface of a normal brachial, showing oblique fulcral ridge. × 10.
Fig. 3. Ditto. × 24.
Fig. 4. Joint-surface of a syzygial brachial. × 9.
Fig. 5. Ditto. × 10.
Fig. 6. Joint-surface of a normal brachial from the proximal region of the arm. × 6.
Fig. 7. Joint-surface of a normal brachial. × 4.
Fig. 8. Joint-surface of a normal brachial from the proximal region of the arm; the two halves of the fulcral ridge appear to be at an angle to one another. × 13.
Fig. 9. Joint-surface of a normal brachial, showing at top right-hand corner the facet for the pinnule. × 4.
Fig. 10. Joint-surface of a normal brachial; the fulcral ridge runs in a direction at right-angles to that in figs. 2 & 3. × 4.
Fig. 11. Portion of an arm, showing origin of pinnules, the fourth joint from the right is a syzygy. × 4.
Fig. 12. Joint-surface of a pinnular, showing axial canal with ligament-depression on either side. × 30.
Fig. 13. A single brachial, bearing on its right side a pinnule, of which ten ossicles are preserved. × 6.
Fig. 14. Portion of a pinnule from the ventral side; the pinnulars are slightly shifted, so that portions of their proximal joint-surfaces are seen. × 12.

Figs. 1, 11, 12, 13, 14 are by F. O. Pickard Cambridge, the rest by the author, and are all taken from E 6327.

PLATE LV.

An attempt at an exact restoration of *Uintacrinus socialis*, represented as swimming, five alternate arms raised, and five in the act of depression. The various twists and coils of the arms are but slightly modified from actual specimens. The length of the arms is based on calculations from the specimens (see pages 987–8). The drawing was made of the natural size, by Mr. F. O. Pickard Cambridge, under the direction of the author, and has been reduced photographically to about one-sixth natural size.

PLATE LVI.

Uintacrinus socialis.

This is a reproduction of Clark's (7) plate i. from Bull. U.S. Geol. Surv. no. 97. The electrotype of the original block was very kindly sent by Mr. C. D. Walcott, Director of the U.S. Geological Survey, and my best thanks are due to him for permission to use it.

Fig. 1*a*. "Lateral view of the test, with interradial area central, natural size." This clearly is taken from one of the specimens figured by Meek (3). Compare text-figure 2, page 976.
Fig. 1*b*. "Test with arms." This also is doubtless natural size.
Fig. 1*c*. "A radial [*i. e.* interdistichal] area, magnified two diameters."

APPENDIX.

LIST OF ADDITIONS TO THE SOCIETY'S MENAGERIE

DURING THE YEAR

1895.

Jan. 1. 2 Long-nosed Crocodiles (*Crocodilus cataphractus*). From the Bonny River, W. Africa. Presented by Capt. F. W. Raisin.

4. 1 Black-eared Marmoset (*Hapale penicillata*). Presented by the Lord Auckland, F.Z.S.

1 Sparrow-Hawk (*Accipiter nisus*). Presented by A. M. Lees-Milne, Esq.

5. 1 Pardine Genet (*Genetta pardina*). Presented by F. E. W. Batt, Esq., Lt. 1st W. I. Regt.

1 Two-spotted Paradoxure (*Nandinia binotata*). Presented by F. E. W. Batt, Esq., Lt. 1st W. I. Regt.

2 Grey Parrots (*Psittacus erithacus*). Deposited.

1 Robben-Island Snake (*Coronella phocarum*). Presented by G. R. Picton Thwaites, Esq.

14. 1 Derbian Wallaby (*Halmaturus derbianus*), ♀. Presented by Mr. Joseph Palmer.

1 Rose-billed Duck (*Metopiana peposaca*), ♂. Purchased.

1 Garden's Night-Heron (*Nycticorax gardeni*). Purchased.

3 Eroded Cinixys (*Cinxys erosa*). Presented by J. Banks Elliott, Esq.

2 Home's Cinixys (*Cinixys homeana*). Presented by J. Banks Elliott, Esq.

15. 1 Dusty Ichneumon (*Herpestes pulverulentus*). Presented by J. E. Matcham, Esq.

16. 1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by H. Ralls, Esq.

1 Black-backed Jackal (*Canis mesomelas*). Presented by Mr. Fred. Bissmire.

1 Jackal Buzzard (*Buteo jacal*). Presented by E. Wingate, Esq.

1 White-throated Monitor (*Varanus albigularis*). Presented by J. E. Matcham, Esq.

1 Lesueur's Water-Lizard (*Physignathus lesueuri*). Deposited.

17. 1 Yellow-headed Conure (*Conurus jendaya*). Presented by Mrs. Hankey.

1 Brown-throated Conure (*Conurus æruginosus*). Presented by Mrs. Hankey.

Jan. 21. 1 Hog Deer (*Cervus porcinus*), ♀. Born in the Menagerie.
1 Little Auk (*Mergulus alle*). Presented by Hamon Le Strange, Esq., F.Z.S.
2 Mantell's Apteryxes (*Apteryx mantelli*). Deposited.
22. 1 Cardinal Grosbeak (*Cardinalis virginianus*), ♂. Presented by F. Beresford Wright, Esq.
1 Little Auk (*Mergulus alle*). Presented by Col. Feilden.
25. 1 Black Iguana (*Metopoceros cornutus*). Deposited.
26. 1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by Miss Teresa M. L. Monteath.
1 Guillemot (*Lomvia troile*). Purchased.
2 Leopard Tortoises (*Testudo pardalis*). Presented by J. E. Matcham, Esq.
1 Cape Bucephalus (*Bucephalus capensis*). Presented by J. E. Matcham, Esq.
28. 1 Chacma Baboon (*Cynocephalus porcarius*), ♂. Presented by Capt. Webster.
31. 1 White-throated Capuchin (*Cebus hypoleucus*). Presented by H. W. Manning, Esq.

Feb. 2. 1 Senegal Parrot (*Pœocephalus senegalus*). Presented by Miss Firmin.
4. 1 Lion (*Felis leo*), ♂. Presented by H.R.H. The Duke of Connaught, K.G., F.Z.S.
8. 1 Cape Bucephalus (*Bucephalus capensis*). Presented by J. E. Matcham, Esq.
12. 1 Snowy Owl (*Nyctea scandiaca*). From Norway. Presented by Miss Wright.
16. 1 Dunlin (*Tringa alpina*). Purchased.
18. 1 Hairy-rumped Agouti (*Dasyprocta prymnolopha*). Presented by Miss W. B. Jackson.
1 Fieldfare (*Turdus pilaris*). Presented by Gervase F. Mathew, Esq.
19. 1 Eland (*Oreas canna*), ♀. Born in the Menagerie.
2 Collared Fruit-Bats (*Cynonycteris collaris*). Born in the Menagerie.
22. 1 Derbian Wallaby (*Halmaturus derbianus*), ♂. Presented by Miss H. M. Howes.
23. 1 Lion (*Felis leo*), ♂. From Harar, Somaliland. Presented by H.M. The Queen.
2 Lions (*Felis leo*), ♂ ♀. From Harar, Somaliland. Deposited by H.M. The Queen.
1 Roseate Cockatoo (*Cacatua roseicapilla*). Presented by A. Reynart, Esq.
4 Triangular-spotted Pigeons (*Columba guinea*). Presented by J. E. Matcham, Esq.
2 Moorish Harriers (*Circus maurus*). Presented by J. E. Matcham, Esq.
2 Spotted Eagle-Owls (*Bubo maculosus*). Presented by J. E. Matcham, Esq.
25. 2 Sclater's Penguins (*Eudyptes sclateri*). Deposited.
26. 1 Giraffe (*Camelopardalis giraffa*), ♀. From the Sabri River, S.E. Africa. Purchased. See P. Z. S. 1895, p. 161.
2 Brindled Gnus (*Connochætes taurina*), ♂ ♀. Purchased. See P. Z. S. 1895, p. 161.
2 Sable Antelopes (*Hippotragus niger*), ♂ ♀. Purchased. See P. Z. S. 1895, p. 161.

Feb. 26. 1 Black-headed Gull (*Larus ridibundus*). Presented by Mrs. Rees Davis.
28. 1 Levaillant's Cynictis (*Cynictis levaillanti*). Purchased.
4 Black Francolins (*Francolinus vulgaris*), 1 ♂, 3 ♀. Deposited.

Mar. 1. 1 Jackal Buzzard (*Buteo jacal*). Presented by J. E. Matcham, Esq.
1 Robben-Island Snake (*Coronella phocarum*). Presented by Dr. Arthur Bensusan.
1 Robben-Island Snake (*Coronella phocarum*). Deposited.
2. 2 Great Eagle-Owls (*Bubo maximus*). Purchased.
4. 1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by Mrs. Turner-Turner.
1 Sykes's Monkey (*Cercopithecus albogularis*), ♀. Purchased.
1 Azara's Fox (*Canis azaræ*). Presented by Messrs. Edgar and Harold Turner.
2 Red-crested Pochards (*Fuligula rufina*), ♂ ♀. Purchased.
6. 1 Great Kangaroo (*Macropus giganteus*), ♂. Born in the Menagerie.
4 Amaduvade Finches (*Estrelda amandava*). Presented by Mrs. Faulknor.
1 Chukar Partridge (*Caccabis chukar*), ♀. Deposited.
8. 3 Hunter's Spiny Mice (*Acomys hunteri*). Born in the Menagerie.
11. 4 Marbled Newts (*Molge marmorata*). Purchased.
12. 1 Vulpine Phalanger (*Phalangista vulpina*). Presented by Richmond Allen, Esq., F.R.C.S.
1 Long-necked Chelodine (*Chelodina longicollis*). Deposited.
13. 1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by Miss K. Fleming.
1 Grey Ichneumon (*Herpestes griseus*). Presented by Mrs. Lewis.
14. 15 Pacific Rats (*Mus exulans*). From Sunday Island, Kermadec Group. Presented by the Countess of Glasgow.
1 Hooded Finch (*Spermestes cucullata*). Presented by C. H. Hastings, Esq.
1 Chestnut-eared Finch (*Amadina castanotis*). Presented by C. H. Hastings, Esq.
1 Woodcock (*Scolopax rusticula*). Presented by Chas. Smoothy, Esq.
15. 1 Vervet Monkey (*Cercopithecus lalandii*), ♀. Presented by Capt. Scarlett Vale.
18. 1 Sand-Badger (*Meles ankuma*). Presented by Fred. Ringer, Esq.
1 Black-backed Piping-Crow (*Gymnorhina tibicen*). Presented by Mrs. J. D. Haggard.
19. 2 Polar Bears (*Ursus maritimus*), ♂ ♀. Presented by John I. Hughes, Esq.
1 Purple-breasted Lory (*Eos riciniata*). Purchased.
1 Blue-faced Honey-eater (*Entomyza cyanotis*). Purchased.
21. 1 Chimpanzee (*Anthropopithecus troglodytes*), ♀. Deposited.
1 Raven (*Corvus corax*). Presented by W. Hillary, Esq.
1 Puff-Adder (*Vipera arietans*). Presented by Dr. A. Donaldson Smith.
22. 1 Common Marmoset (*Hapale jacchus*). Deposited.
1 Spotted Hyæna (*Hyæna crocuta*, jr.). From British East Africa. Presented by T. E. C. Remington, Esq.

Mar. 22. 1 Vociferous Sea-Eagle (*Haliaëtus vocifer*). From British East Africa. Presented by T. E. C. Remington, Esq.

1 Egyptian Kite (*Milvus ægyptius*). From British East Africa. Presented by T. E. C. Remington, Esq.

25. 1 Palm Squirrel (*Sciurus palmarum*). Presented by Mrs. Henry Jones.

1 Vulpine Phalanger (*Phalangista vulpina*), ♀. Presented by Master John Simonds.

1 Variegated Bittern (*Ardetta involucris*). Purchased.

1 White-spotted Rail (*Rallus maculatus*). Purchased.

1 Sooty Rail (*Rallus rythyrhynchus*). Purchased.

1 Rosy-billed Duck (*Metopiana peposaca*), ♀. Purchased.

4 Burrowing-Owls (*Speotyto cunicularia*). Purchased.

26. 1 Bronze-winged Pigeon (*Phaps chalcoptera*), ♂. Presented by Lady Buchan-Hepburn.

27. 1 Rhesus Monkey (*Macacus rhesus*), ♀. Presented by W. H. Haynes, Esq.

28. 1 Vervet Monkey (*Cercopithecus lalandii*), ♀. Presented by H. W. Weguelin, Esq.

1 Egyptian Jerboa (*Dipus ægyptius*). Presented by G. L. Johnson, Esq., M.D., F.Z.S.

1 Oak Dormouse (*Myoxus dryas*). Presented by G. L. Johnson, Esq., M.D., F.Z.S.

1 Oak Dormouse (*Myoxus dryas*). Deposited.

1 Cape Viper (*Causus rhombeatus*). Presented by J. E. Matcham, Esq.

29. 1 Brazilian Three-banded Armadillo (*Tolypeutes tricinctus*), ♂. Purchased. See P. Z. S. 1895, p. 273.

1 Grey-breasted Parrakeet (*Bolborhynchus monachus*). Presented by Rowland Ward, Esq., F.Z.S.

30. 1 Hoolock Gibbon (*Hylobates hoolock*), ♂. Deposited.

1 Pardine Genet (*Genetta pardina*). Presented by Geo. Danes, Esq.

2 Gazelles (*Gazella dorcas*), ♂ ♀. Deposited.

1 Short-tailed Wallaby (*Halmaturus brachyurus*), ♀. Presented by Mr. L. Thompson.

April 1. 7 Common Skinks (*Scincus officinalis*). From the Sahara Desert. Presented by Major Sulivan.

3. 1 Haast's Apteryx (*Apteryx haasti*). Deposited.

1 Auckland-Island Duck (*Nesonetta aucklandica*). Deposited.

4. 1 Ring-necked Parrakeet (*Palæornis torquatus*), ♂. Presented by Lady Aitchison.

2 Hybrid Wigeon (between *Mareca penelope* ♂ and *Mareca chiloensis* ♀), ♂ ♀. Presented by J. Charlton Parr, Esq., F.Z.S.

5. 1 Feline Douroucouli (*Nyctipithecus vociferans*). Deposited.

1 Squirrel-Monkey (*Chrysothrix sciurea*). Deposited.

6. 9 Hamadryads (*Ophiophagus elaps*). Deposited.

8. 1 Cape Viper (*Causus rhombeatus*). Presented by J. E. Matcham, Esq.

9. 4 Indian Pythons (*Python molurus*). Deposited.

1 Barbary Wild Sheep (*Ovis tragelaphus*). Born in the Menagerie.

10. 1 Irish Stoat (*Putorius hibernicus*). Presented by the Viscount Powerscourt, F.Z.S.

1 Grey Parrot (*Psittacus erithacus*). Presented by A. A. Dowty, Esq.

Apr. 10. 2 Elephantine Tortoises (*Testudo elephantina*). Deposited.
15. 1 Irish Stoat (*Putorius hibernicus*). Presented by the Viscount Powerscourt, F.Z.S. See P. Z. S. 1895, p. 337.
16. 1 Egyptian Gazelle (*Gazella dorcas*), ♂. Received in Exchange.
2 Griffon Vultures (*Gyps fulvus*). Purchased.
2 Scarlet Tanagers (*Ramphocœlus brasilius*), 2 ♂. Presented by Robert E. Graves, Esq., F.Z.S.
17. 1 Common Badger (*Meles taxus*). Presented by H.G. The Duke of Wellington, F.Z.S.
1 Red-and-Blue Macaw (*Ara macao*). Deposited.
18. 2 Polar Hares (*Lepus glacialis*). From Norway. Presented by O. Gude, Esq. See P. Z. S. 1895, p. 337.
1 Antipodes-Island Parrakeet (*Cyanorhamphus unicolor*). Presented by Sir Walter L. Buller, K.C.M.G., C.M.Z.S.
1 Antipodes-Island Parrakeet (*Cyanorhamphus unicolor*). Presented by Wm. E. Collins, Esq. See P. Z. S. 1895, p. 337.
20. 1 Bonnet-Monkey (*Macacus sinicus*), ♀. Presented by R. J. Davidson, Esq.
1 Green Monkey (*Cercopithecus callitrichus*), ♀. Presented by Miss Florence Griffin.
1 Great Kangaroo (*Macropus giganteus*), ♂. Born in the Menagerie.
1 Rufous Rat-Kangaroo (*Hypsiprymnus rufescens*), ♀. Born in the Menagerie.
22. 1 Rhesus Monkey (*Macacus rhesus*), ♂. Presented by Mr. Julius Scovell.
1 Antipodes-Island Parrakeet (*Cyanorhamphus unicolor*). Deposited.
1 Leopard Tortoise (*Testudo pardalis*). Presented by J. E. Matcham, Esq.
1 Cape Viper (*Causus rhombeatus*). Presented by J. E. Matcham, Esq.
24. 3 Maholi Galagos (*Galago maholi*). Presented by Miss Van Buren.
1 Common Viper (*Vipera berus*). Presented by Mrs. P. C. Mitchell.
25. 1 Angora Goat (*Capra hircus*, var.), ♀. Born in the Menagerie.
1 Crowned Hawk-Eagle (*Spizaëtus coronatus*). From the Cape Colony. Presented by Dr. Schönnland.
3 Green Lizards (*Lacerta viridis*). Presented by Masters J. S. & A. H. Hills.
27. 1 Pig-tailed Monkey (*Macacus nemestrinus*), ♀. Presented by D'Orville B. Dawson, Esq.
1 Angora Goat (*Capra hircus*, var.). Born in the Menagerie.
1 Undulated Grass-Parrakeet (*Melopsittacus undulatus*). Bred in the Menagerie.
29. 1 Common Squirrel (*Sciurus vulgaris*). Presented by Mrs. Herbert Morris.
4 Yellow-bellied Liothrix (*Liothrix luteus*). Presented by Albert Kettich, Esq.
2 Alpine Choughs (*Pyrrhocorax alpinus*). Purchased.
1 Puff-Adder (*Vipera arietans*). Presented by J. E. Matcham, Esq.

May 1. 1 Black-billed Sheathbill (*Chionis minor*). Captured at Sea, 52° S., 55° W. Presented by Mr. John Gunn. See P. Z. S. 1895, p. 520.

May 1. 1 Water-Rail (*Rallus aquaticus*). Presented by Mr. John Gunn.

3. 1 English Wild Cow (*Bos taurus*, var.). Born in the Menagerie.

5 Hunter's Spiny Mice (*Acomys hunteri*). Born in the Menagerie.

1 Lear's Macaw (*Ara leari*). Deposited.

1 Rock-hopper Penguin (*Eudyptes chrysocome*). Deposited.

1 Red-masked Conure (*Conurus erythrogenys*). Deposited.

4. 1 Lineolated Parrakeet (*Bolborhynchus lineolatus*). Presented by Mr. Edward Hawkins.

4 White-backed Pigeons (*Columba leuconota*). Deposited.

6. 1 Arabian Baboon (*Cynocephalus hamadryas*), ♂. From Somaliland. Presented by Francis G. Gunnis, Esq.

1 Arabian Baboon (*Cynocephalus hamadryas*), ♀. From Somaliland. Presented by Mrs. E. Lort Phillips.

1 Koodoo (*Strepsiceros kudu*), ♀. From Somaliland. Presented by E. Lort Phillips, Esq., F.Z.S.

1 Large Red Flying-Squirrel (*Pteromys inornatus*). Received in Exchange.

2 Indian Pythons (*Python molurus*). Presented by Mr. G. Stephen.

1 Dusky Bulbul (*Pcynonotus obscurus*). Deposited.

7. 1 Barbary Sheep (*Ovis tragelaphus*), ♂. Born in the Menagerie.

1 Japanese Deer (*Cervus sika*), ♂. Born in the Menagerie.

1 Black Tanager (*Tachyphonus melaleucus*), ♀. Presented by Mr. Edward Hawkins.

2 Pyrenean Newts (*Molge aspera*). From the Lac d'Oncet, Pyrénees. Presented by Dr. Jacques de Bedriaga, C.M.Z.S.

8. 1 Hawfinch (*Coccothraustes vulgaris*), ♂. Presented by H. G. Devas, Esq.

9. 1 Naked-footed Owlet (*Athene noctua*). Presented by Walter Chamberlain, Esq., F.Z.S.

2 Ruddy Sheldrakes (*Tadorna casarca*), ♂ ♀. Purchased.

10. 1 Japanese Ape (*Macacus speciosus*), ♂. Presented by G. L. Johnson, Esq., M.D., F.Z.S.

11. 1 Kinkajou (*Cercoleptes caudivolvulus*). Deposited.

1 Ring-tailed Coati (*Nasua rufa*). Deposited.

1 Japanese Deer (*Cervus sika*), ♀. Born in the Menagerie.

1 Yellow-fronted Amazon (*Chrysotis ochrocephala*). Purchased.

1 Red-fronted Amazon (*Chrysotis vittata*). Purchased.

1 Rhesus Monkey (*Macacus rhesus*), ♂. Presented by Messrs. A. S. and E. Boatfield.

2 Common Peafowls (*Pavo cristatus*), ♂ ♀. Presented by Mrs. Whatman.

13. 2 Great Wallaroos (*Macropus robustus*), ♂ ♀. Deposited.

1 Blue-and-Yellow Macaw (*Ara ararauna*). Deposited.

1 Cambayan Turtle-Dove (*Turtur senegalensis*). Presented by C. L. Sutherland, Esq., F.Z.S.

1 Malaccan Parrakeet (*Palæornis longicauda*), ♂. Received in Exchange.

14. 1 Bennett's Wallaby (*Halmaturus bennetti*), ♂. Born in the Menagerie.

15. 1 Vervet Monkey (*Cercopithecus lalandii*), ♀. Presented by Alfred James, Esq.

May 15. 1 Dorsal Squirrel (*Sciurus dorsalis*). Presented by Mrs. Brett.
1 Common Jackal (*Canis aureus*). From Egypt. Presented by Dr. John Anderson, F.R.S., F.Z.S.
2 Bengal Foxes (*Canis bengalensis*). Presented by Dr. John Anderson, F.R.S., F.Z.S.
1 Jungle Cat (*Felis chaus*). Presented by Dr. John Anderson, F.R.S., F.Z.S.
16. 2 Short-tailed Capromys (*Capromys brachyurus*). From Jamaica. Presented by Frank Cundall, Esq.
1 Sallé's Amazon (*Chrysotis sallæi*). Presented by Wm. Windsor Spriggs, Esq.
2 Canada Geese (*Bernicla canadensis*), ♂ ♀. Purchased.
13 Green Lizards (*Lacerta viridis*). Purchased.
1 Spotted Salamander (*Salamandra maculosa*). Presented by E. Layton-Bennett, Esq.
17. 2 Agile Wallabies (*Halmaturus agilis*). Deposited.
4 Squirrel-like Phalangers (*Belideus sciureus*). Presented by the Rt. Hon. Earl Cadogan, K.G.
1 Short-headed Phalanger (*Belideus breviceps*). Presented by the Rt. Hon. Earl Cadogan, K.G.
1 Nicobar Pigeon (*Calœnas nicobarica*). Received in Exchange.
18. 2 Yellow Weaver-birds (*Sitagra luteola*). Purchased.
21. 1 Wapiti Deer (*Cervus canadensis*), ♀. Born in the Menagerie.
1 Japanese Deer (*Cervus sika*), ♀ Born in the Menagerie.
23. 6 Hairy-footed Jerboas (*Dipus hirtipes*).
2 Lesser Egyptian Gerbilles (*Gerbillus ægyptius*).
2 Libyan Zorillas (*Ictonyx lybica*).
2 Grey Monitors (*Varanus griseus*).
2 Egyptian Mastigures (*Uromastix spinipes*).
1 Common Chameleon (*Chamæleon vulgaris*).
3 Egyptian Geckos (*Tarentola annularis*).
7 Common Skinks (*Scincus officinalis*).
2 Cerastes Vipers (*Vipera cerastes*), 2 ♀.
2 Diademed Snakes (*Zamenis diadema*).
From Egypt. Presented by Dr. John Anderson, F.R.S., F.Z.S.
24. 1 Burchell's Zebra (*Equus burchelli*), ♂. Born in the Menagerie.
25. 2 Variable Hares (*Lepus variabilis*). Born in the Menagerie.
1 Grysbok (*Neotragus melanotis*), ♀. Presented by J. E. Matcham, Esq. See P. Z. S. 1895, p. 520.
27. 1 Spiny Tree-Porcupine (*Sphingurus spinosus*). Deposited.
1 Rufescent Snake (*Leptodera rufescens*). Presented by J. E. Matcham, Esq.
28. 2 Guira Cuckoos (*Guira piririgua*). Purchased.
1 Wild Duck (*Anas boschas*), ♂. Purchased.
29. 1 Green Monkey (*Cercopithecus callitrichus*), ♀. Deposited.
1 Panolia Deer (*Cervus eldi*), ♂. From Southern China. Presented by Julius Neumann, Esq. See P. Z. S. 1895, p. 520.
30. 1 Ruddy Ichneumon (*Herpestes smithi*). Presented by the Earl of Hopetoun, F.Z.S.
1 Spotted Ichneumon (*Herpestes nepalensis*). Presented by Mrs. Thompson.

May 30. 1 Blossom-headed Parrakeet (*Palæornis cyanocephala*). Presented by Mrs. Loftie.

31. 1 Rosy-faced Love-bird (*Agapornis roseicollis*). Presented by Cecil M. Bevan, Esq.

2 Tuberculated Iguanas (*Iguana tuberculata*). Deposited.

June 1. 1 Japanese Deer (*Cervus sika*), ♀. Born in the Menagerie.

4. 1 Rhesus Monkey (*Macacus rhesus*), ♀. Presented by R. Edmeades, Esq.

5. 1 Red Deer (*Cervus elaphus*), ♂. Born in the Menagerie.

1 Herring-Gull (*Larus argentatus*). Presented by Mr. J. T. Gorvin.

6. 1 Campbell's Monkey (*Cercopithecus campbelli*), ♂. Presented by Miss L. Panther.

2 White Pelicans (*Pelecanus onocrotalus*). Deposited.

3 Ocellated Sand-Skinks (*Seps ocellatus*). Presented by Dr. John Anderson, F.R.S., F.Z.S.

1 Audouin's Skink (*Chalcides sepoides*). Presented by Dr. John Anderson, F.R.S., F.Z.S.

1 Defenceless Lizard (*Agama inermis*). Presented by Dr. John Anderson, F.R.S., F.Z.S.

2 Diademed Snakes (*Zamenis diadema*). Presented by Dr. John Anderson, F.R.S., F.Z.S.

2 Moila Snakes (*Cœlopeltis moilensis*). From Mount Sinai. Presented by Dr. John Anderson, F.R.S., F.Z.S.

4 Egyptian Eryx (*Eryx jaculus*). Presented by Dr. John Anderson, F.R.S., F.Z.S.

2 Cerastes Vipers (*Vipera cerastes*). Presented by Dr. John Anderson, F.R.S., F.Z.S.

2 Egyptian Cobras (*Naia haje*). Presented by Dr. John Anderson, F.R.S., F.Z.S.

7. 1 Rhesus Monkey (*Macacus rhesus*), ♂. Presented by Sir Henry W. Peek, Bt., J.P., F.Z.S.

1 Sharp-snouted Snake (*Passerita mycterizans*). Presented by Mr. W. Moor.

1 Patas Monkey (*Cercopithecus ruber*), ♀. Presented by C. H. Armitage, Esq.

1 White-crowned Monkey (*Cercocebus æthiops*). Presented by C. H. Armitage, Esq.

1 White-necked Stork (*Dissura episcopus*). Presented by C. H. Armitage, Esq.

1 Barraband's Parrakeet (*Polytelis barrabandi*). Deposited.

8. 50 Changeable Tree-Frogs (*Hyla versicolor*). Deposited.

3 Hamadryads (*Ophiophagus elaps*). Deposited.

9. 1 Argus Pheasant (*Argus giganteus*). Bred in the Menagerie.

3 Ruddy-headed Geese (*Bernicla rubidiceps*). Bred in the Menagerie.

10. 1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by Mr. Charles Roberts.

1 Common Otter (*Lutra vulgaris*), ♂. Presented by M. P. Clarke, Esq.

1 Northern Mocking-bird (*Mimus polyglottus*). Presented by Henry J. Fulljames, Esq.

2 Nicobar Pigeons (*Calœnas nicobarica*). Purchased.

11. 1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by Miss Wieldt.

June 11. 1 Black-spotted Teguexin (*Tupinambis nigropunctatus*). Deposited.
1 Thar (*Capra jemlaica*), ♀. Born in the Menagerie.
1 Red Deer (*Cervus elaphus*). Born in the Menagerie.
3 Common Raccoons (*Procyon lotor*). Born in the Menagerie.
12. 2 Southern River-Hogs (*Potomachœrus africanus*), ♂ ♀. Presented by the late B. Ward, Esq.
1 Yellow-throated Sparrow (*Gymnorhis flavicollis*). Presented by Frank Finn, Esq., F.Z.S.
1 Double-banded Pigeon (*Treron bicincta*). Presented by Frank Finn, Esq., F.Z.S.
2 Chinese Quails (*Coturnix chinensis*). Presented by Frank Finn, Esq., F.Z.S.
2 White-breasted Gallinules (*Gallinula phœnicura*). Presented by Frank Finn, Esq., F.Z.S.
5 Magellanic Geese (*Bernicla magellanica*). Bred in the Menagerie.
2 Variegated Sheldrakes (*Tadorna variegata*). Bred in the Menagerie.
1 Reticulated Python (*Python reticulatus*). Received in Exchange.
13. 1 Sharp-nosed Crocodile (*Crocodilus acutus*). Presented by Lady Blake.
1 European Pond-Tortoise (*Emys europæa*). Presented by Miss Laura Bedford.
14. 1 Leopard (*Felis pardus*), ♀. Presented by Edward Langworthy, Esq.
1 Ring-tailed Phalanger (*Pseudochirus peregrinus*), ♀. Purchased.
15. 2 Weka Rails (*Ocydromus australis*). Presented by Reginald Moorhouse, Esq.
17. 1 Rhesus Monkey (*Macacus rhesus*), ♀. Presented by Mrs. Stevens.
1 Korin Gazelle (*Gazella rufifrons*), ♀. Deposited.
1 Naked-necked Iguana (*Iguana delicatissima*). Deposited.
1 Burrhel Wild Sheep (*Ovis burrhel*), ♀. Bred in the Menagerie.
1 Patagonian Cavy (*Dolichotis patachonica*). Bred in the Menagerie.
2 Banded Parrakeets (*Palæornis fasciatus*), 2 ♂. Presented by Lieut.-Gen. Sir H. B. Lumsden, Bart., K.C.S.I., F.Z.S.
18. 2 Crested Pigeons (*Ocyphaps lophotes*). Bred in the Menagerie.
2 Triangular-spotted Pigeons (*Columba guinea*). Bred in the Menagerie.
2 Vinaceous Doves (*Turtur vinaceus*). Bred in the Menagerie.
2 Undulated Grass-Parrakeets (*Melopsittacus undulatus*). Bred in the Menagerie.
19. 1 Blue-and-Yellow Macaw (*Ara ararauna*). Deposited.
1 White-crested Jay-Thrush (*Garrulax leucolophus*). Received in Exchange.
1 Striated Jay-Thrush (*Grammatoptila striata*). Received in Exchange.
3 Glossy Ibises (*Plegadis falcinellus*). Bred in the Menagerie.
20. 9 Red-beaked Weaver-birds (*Quelea sanguirostris*), 4 ♂, 5 ♀. Purchased.
21. 1 Green-winged Trumpeter (*Psophia viridis*). Presented by H. A. Astlett, Esq.

June 21. 1 Tachiro Goshawk (*Astur tachiro*). Purchased.
34 Black Salamanders (*Salamandra atra*). Deposited.
22. 1 Diamond Snake (*Morelia spilotes*). Presented by M. Mitchener, Esq.
1 Natal Python (*Python natalensis*). Presented by Wm. Norman, Esq.
24. 1 Thar (*Capra jemlaica*), ♀. Born in the Menagerie.
1 Common Rhea (*Rhea americana*). Deposited.
25. 2 Wild Ducks (*Anas boscas*), 2 ♀. Purchased.
26. 1 Rough Fox (*Canis rudis*). Presented by Dr. Irvine K. Reid.
1 Black-eared Marmoset (*Hapale penicillata*). Presented by H. P. Roberts, Esq.
2 Black-necked Swans (*Cygnus nigricollis*). Purchased.
27. 1 Burchell's Zebra (*Equus burchelli*), ♂. Purchased.
1 Bonnet-Monkey (*Macacus sinicus*), ♀. Presented by John Norbury, jr., Esq.
3 Blue Snow-Geese (*Chen cærulescens*). Purchased.
28. 1 Grey Ichneumon (*Herpestes griseus*). Presented by Lady Champion de Crespigny.
29. 1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by Mr. H. W. Ball.
7 Black Salamanders (*Salamandra atra*). Presented by the Rev. J. W. Horsley.
1 Slowworm (*Anguis fragilis*). Presented by the Rev. J. W. Horsley.

July 1. 1 Anubis Baboon (*Cynocephalus anubis*), ♂. Presented by W. H. Adams, Esq.
1 Leopard (*Felis pardus*). Presented by W. H. Adams, Esq.
2 Two-spotted Paradoxures (*Nandinia binotata*). Presented by W. H. Adams, Esq.
1 Sharpe's Wood-Owl (*Syrnium nuchale*). Presented by W. H. Adams, Esq.
2. 2 Mantchurian Cranes (*Grus viridirostris*). Purchased.
2 Red-crested Cardinals (*Paroaria cucullata*). Presented by Dr. G. Fielding Blandford, F.Z.S.
2 Mule Deer (*Cariacus macrotis*). Born in the Menagerie.
3. 1 Campbell's Monkey (*Cercopithecus campbelli*), ♂. Deposited.
1 Spiny-tailed Monitor (*Varanus acanthurus*). From Roebuck Bay, W. Australia. Presented by W. Saville Kent, Esq., F.Z.S.
4. 1 Brown Capuchin (*Cebus fatuellus*). Presented by W. E. Gibbs, Esq., J.P.
1 Egyptian Uromastix (*Uromastix spinipes*). Deposited.
1 Rough-keeled Snake (*Dasypeltis scabra*). Presented by Mr. A. W. Arrowsmith.
5. 1 Small Hill-Mynah (*Gracula religiosa*). Presented by W. Norbury, Esq.
2 Plumed Ground-Doves (*Geophaps plumifera*). Hatched in the Gardens.
7. 1 Japanese Deer (*Cervus sika*), ♂. Born in the Menagerie.
8. 4 Common Chameleons (*Chamæleon vulgaris*). From Moses Wells, Sinai Peninsula. Presented by J. C. Mitchell, Esq.
9. 1 Wapiti Deer (*Cervus canadensis*), ♀. Born in the Menagerie.
1 Yellow-billed Sheathbill (*Chionis alba*). Captured at Sea, 300 miles off the Falkland Islands. Presented by Capt. C. Plunkett.

July 11. 1 Alexandra Parrakeet (*Polytelis alexandræ*). Deposited. See P. Z. S. 1895, p. 687.

6 Grey Francolins (*Francolinus ponticerianus*), 6 ♂. Deposited.

2 Short-headed Phalangers (*Belideus breviceps*). Born in the Menagerie.

12. 1 Garnett's Galago (*Galago garnetti*), ♀. From British East Africa. Presented by C. H. E. Hall, Esq.

1 Campbell's Monkey (*Cercopithecus campbelli*). Presented by Miss C. Thompson.

2 Sharp-nosed Crocodiles (*Crocodilus acutus*). Presented by James G. Green, Esq.

1 Royal Python (*Python regius*). Presented by H.E. Col. Frederic Cardew, C.M.G.

1 Black Tortoise (*Testudo carbonaria*). Deposited.

13. 5 Fennec Foxes (*Canis cerdo*).
2 North-African Jackals (*Canis anthus*).
2 Libyan Zorillas (*Ictonyx libyca*).
2 Egyptian Cats (*Felis chaus*).
3 Dorcas Gazelles (*Gazella dorcas*).
4 White Pelicans (*Pelecanus onocrotalus*).
1 Grey Monitor (*Varanus griseus*).
From Egypt. Received in Exchange.

15. 1 Japanese Deer (*Cervus sika*), ♀. Born in the Menagerie.

1 West-African Python (*Python sebæ*). Presented by Edward Straw, Esq.

16. 1 Rhesus Monkey (*Macacus rhesus*), ♂. Presented by Mr. A. Kegele.

1 Irish Stoat (*Putorius hibernicus*). Presented by the Viscount Powerscourt, F.Z.S.

1 Suricate (*Suricata tetradactyla*), ♂. Presented by Miss Dorothy Lowndes.

1 Red-sided Tit (*Parus varius*). Deposited.

1 White-browed Amazon (*Chrysotis albifrons*). Deposited.

19. 2 Adorned Terrapins (*Clemmys ornata*). Deposited.

20. 1 Bosch-bok (*Tragelaphus sylvaticus*), ♂. Presented by W. Champion, Esq.

1 Mozambique Monkey (*Cercopithecus pygerythus*), ♀. Presented by Mrs. A. Canning Fysh.

21. 1 Bullfinch (*Pyrrhula europæa*), ♂. Presented by Miss Munt.

6 Orbicular Horned Lizards (*Phrynosoma orbiculare*). Presented by E. J. Scarborough, Esq.

22. 1 Common Marmoset (*Hapale jacchus*). Presented by Mrs. Florence Cowlard.

1 Frilled Lizard (*Chlamydosaurus kingi*). From Roebuck Bay, Western Australia. Presented by W. Saville Kent, Esq., F.L.S., F.Z.S. See P. Z. S. 1895, pp. 687, 712, pl. xli.

1 Eyed Lizard (*Lacerta ocellata*). Deposited.

23. 1 Serval (*Felis serval*). From Mozambique. Presented by W. A. Churchill, Esq.

1 White-necked Stork (*Dissura episcopus*). From Mozambique. Presented by W. A. Churchill, Esq.

1 Vociferous Sea-Eagle (*Haliaëtus vocifer*). From Mozambique. Presented by W. A. Churchill, Esq.

1 Antarctic Skua (*Stercorarius antarcticus*). From Mozambique. Presented by W. A. Churchill, Esq.

3 Viperine Snakes (*Tropidonotus viperinus*). Presented by E. A. Minchin, Esq.

July 23. 1 Common Snake (*Tropidonotus natrix*). Presented by E. A. Minchin, Esq.
2 Pratincoles (*Glareola pratincola*). Deposited.
25. 1 Cardinal Grosbeak (*Cardinalis virginianus*), ♂. Presented by Miss E. A. Krumbholz.
1 Lazuline Finch (*Guiraca parellina*), ♂. Presented by Miss E. A. Krumbholz.
2 Long-nosed Crocodiles (*Crocodilus cataphractus*). Presented by A. G. Griffith, Esq.
26. 1 Rhesus Monkey (*Macacus rhesus*), ♂. Presented by Capt. Fitzgerald.
1 Orbicular Horned Lizard (*Phrynosoma orbiculare*). Presented by Miss Mabel Baker.
2 Noisy Frogs (*Rana clamata*). Deposited.
27. 1 Orang-outang (*Simia satyrus*), ♀. Deposited.
1 Brazilian Tortoise (*Testudo tabulata*). Deposited.
1 Black Tortoise (*Testudo carbonaria*). Deposited.
28. 2 Plumed Ground-Doves (*Geophaps plumifera*). Bred in the Menagerie.
29. 1 Red River-Hog (*Potamochœrus penicillata*), ♀. Purchased.
2 Crested Porcupines (*Hystrix cristata*). Presented by J. E. Matcham, Esq.
2 Cape Zorillas (*Ictonyx zorilla*). Presented by J. E. Matcham, Esq.
30. 1 Macaque Monkey (*Macacus cynomolgus*). Presented by Mrs. Herman Schlesinger.
1 Ducorps's Cockatoo (*Cacatua ducorpsi*). Presented by Mrs. Dexter.
31. 1 Rhesus Monkey (*Macacus rhesus*). Presented by Miss Tolhurst.
1 Black-backed Jackal (*Canis mesomelas*). Deposited.
2 Mandarin Ducks (*Æx galericulata*). Bred in the Menagerie.
2 Gadwalls (*Anas strepera*). Bred in the Menagerie.
3 Australian Wild Ducks (*Anas superciliosa*). Bred in the Menagerie.
3 Chilian Pintail (*Dafila spinicauda*). Bred in the Menagerie.
7 Summer Ducks (*Æx galericulata*). Bred in the Menagerie.
2 Robben-Island Snakes (*Coronella phocarum*). Presented by Barry M^c^Millan, Esq.

Aug. 1. 1 Macaque Monkey (*Macacus cynomolgus*). Presented by Stanley S. Flower, Esq., 5th Fusiliers.
3 Slow Lorises (*Nycticebus tardigradus*). Presented by Stanley S. Flower, Esq., 5th Fusiliers.
1 Geoffroy's Marmoset (*Midas geoffroii*). Presented by Miss Mina Sangiorgi.
1 Sooty Phalanger (*Phalangista fuliginosa*), ♀. Purchased.
1 Nightjar (*Caprimulgus europæus*). Presented by West Carnie, Esq.
1 Basilisk Chameleon (*Chamæleon basiliscus*). Presented by J. Buchanan, Esq. From Egypt. See P. Z. S. 1895, p. 687.
2. 1 Brown Capuchin (*Cebus fatuellus*). Deposited.
1 Green Monkey (*Cercopithecus callitrichus*), ♀. Presented by Mdlle. Eugénie Grobel.
6 Ring-tailed Coatis (*Nasua rufa*), ♂, ♀, and 4 juv. Deposited.
1 De Filippi's Meadow-Starling (*Sturnella defilippii*). Purchased.

Aug. 3. 1 Barbary Ape (*Macacus inuus*), ♀. Presented by Edwin Fletcher, Esq.

6. 1 Larger Hill-Mynah (*Gracula intermedia*). Deposited.

1 Sooty Phalanger (*Phalangista fuliginosa*, white var.), ♂. Deposited.

1 Blossom-headed Parrakeet (*Palæornis cyanocephalus*). Purchased.

7. 3 Alligators (*Alligator mississippiensis*, jr.). Presented by Ernest H. Shackleton, Esq.

1 Rhesus Monkey (*Macacus rhesus*), ♀. Presented by Mr. R. Norton Stevens.

1 Greater Sulphur-crested Cockatoo (*Cacatua galerita*). Deposited.

2 Green Turtles (*Chelone viridis*). Presented by Commander Duncan Campbell.

1 Tuberculated Iguana (*Iguana tuberculata*). Purchased.

8. 1 Kinkajou (*Cercoleptes caudivolvulus*), ♀. Presented by Sydney Matthews, Esq.

1 Yellow Baboon (*Cynocephalus babouin*), ♀. From Parropatti, E. African Coast. Presented by J. V. Williams, Esq.

1 Common Viper (*Vipera berus*). Presented by A. Old, Esq.

2 Triangular-spotted Pigeons (*Columba guinea*). Bred in the Menagerie.

2 Crested Pigeons (*Ocyphaps lophotes*). Bred in the Menagerie.

9. 1 Lion (*Felis leo*), ♀. Deposited.

3 Pumas (*Felis concolor*). Born in the Menagerie.

8 Black Salamanders (*Salamandra atra*). Born in the Menagerie.

10. 1 Macaque Monkey (*Macacus cynomolgus*). Deposited.

3 South-American Rat-Snakes (*Spilotes variabilis*). Deposited.

1 Derbian Sternothere (*Sternothærus derbianus*). Deposited.

12. 2 Gundis (*Ctenodactylus gundi*). From Tunis. Purchased. See P. Z. S. 1895, p. 687.

1 Ruffled Lemur (*Lemur varius*), ♀. Presented by W. B. Bingham, Esq., F.Z.S.

1 Vervet Monkey (*Cercopithecus lalandii*), ♀. Presented by Mrs. C. J. Humphrey.

1 Mozambique Monkey (*Cercopithecus pygerythrus*), ♀. Presented by Mrs. John Mahon.

13. 1 Martial Hawk-Eagle (*Spizaëtus bellicosus*). From Mount Kenia, British East Africa. Presented by Dr. Kolb. See P. Z. S. 1895, p. 687.

14. 1 Cheetah (*Cynælurus jubatus*). From Somaliland. Presented by J. L. Harrington, Esq., J.C.S.

1 Blotched Genet (*Genetta tigrina*). From Somaliland. Presented by J. L. Harrington, Esq., J.C.S.

1 Sooty Mangabey (*Cercocebus fuliginosus*), ♀. Presented by H. A. Davies, Esq.

2 Dorcas Gazelles (*Gazella dorcas*), 2 ♀.
1 Sœmmerring's Gazelle (*Gazella sœmmerringi*), ♂.
1 Egyptian Cat (*Felis chaus*).
3 Libyan Zorillas (*Ictonyx lybica*).
10 Varied Field-Rats (*Isomys variegatus*).
35 Hairy-footed Jerboas (*Dipus hirtipes*).
} From Egypt. Received in Exchange.

Aug. 14. 45 Lesser Egyptian Gerbilles (*Gerbillus ægypticus*).

8 Larger Egyptian Gerbilles (*Gerbillus pyramidum*).

2 Egyptian Kites (*Milvus ægypticus*).

1 Cerastes Viper (*Vipera cerastes*).

From Egypt. Received in Exchange.

15. 2 Orbicular Horned Lizards (*Phrynosoma orbiculare*). Presented by Bernard Jackson, Esq.

2 Ravens (*Corvus corax*). Presented by the Hon. William Edwards.

2 Buzzards (*Buteo vulgaris*). Presented by the Hon. William Edwards.

2 Greater Black-backed Gulls (*Larus marinus*). Presented by the Hon. William Edwards.

4 Spiny-tailed Mastigures (*Uromastix acanthinurus*). Deposited.

16. 1 Rhesus Monkey (*Macacus rhesus*), ♀. Deposited.

1 Side-striped Jackal (*Canis lateralis*). Presented by Mr. J. J. Pinnock.

17. 1 Sykes's Monkey (*Cercopithecus albigularis*), ♂. Presented by J. Watkinson Brown, Esq.

1 Herring-Gull (*Larus argentatus*). Presented by George Hawes, Esq.

18. 1 Spotted Pigeon (*Columba maculosa*). Bred in the Menagerie.

19. 6 Grey Parrots (*Psittacus erithacus*). Deposited.

1 Blood-breasted Pigeon (*Phlogœnas cruentata*). Presented by Wm. H. Cocker, Esq.

1 Rhesus Monkey (*Macacus rhesus*), ♂. Presented by Hugh H. Collis, Esq.

1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by E. Laundy, Esq.

1 Vervet Monkey (*Cercopithecus lalandii*), ♀. Presented by Mrs. Edward Webb.

2 Brown Capuchins (*Cebus fatuellus*). Presented by W. S. D. Liardet, Esq.

20. 2 Black-eared Marmosets (*Hapale penicillata*). Presented by Mrs. H. V. Friend.

1 Suricate (*Suricata tetradactyla*). Presented by Mr. J. Lewis.

21. 1 Purple-capped Lory (*Lorius domicella*). Presented by T. Bailey, Esq.

22. 1 Tawny Owl (*Syrnium aluco*). Presented by C. A. Marriott, Esq.

2 Tarantula Spiders (*Mygale*, sp. inc.). Presented by J. Hoadley, Esq.

24. 1 Collared Fruit-Bat (*Cynonycteris collaris*). Born in the Menagerie.

25. 1 Ypecaha Rail (*Aramides ypecaha*). Bred in the Menagerie.

26. 1 Capuchin (*Cebus*, sp. inc.), ♂. Purchased.

1 Porto-Rico Pigeon (*Columba corensis*). Purchased.

1 Vinaceous Pigeon (*Columba vinacea*). Purchased.

1 Barn-Owl (*Strix flammea*). Purchased.

7 Adorned Ceratophrys (*Ceratophrys ornata*). Purchased.

1 White-tailed Sea-Eagle (*Haliaëtus albicilla*). Presented by Robert Ashton, Esq.

28. 2 Red-backed Shrikes (*Lanius collurio*). Presented by C. Ingram, Esq.

Aug. 28. 1 Natterjack Toad (*Bufo calamita*). Presented by Stanley S. Flower, Esq.
29. 1 Great Kangaroo (*Macropus giganteus*), ♂. Born in the Menagerie.
1 Rufous Rat-Kangaroo (*Hypsiprymnus rufescens*), ♂. Born in the Menagerie.
1 Short-headed Phalanger (*Belideus breviceps*), ♂. Born in the Menagerie.
30. 1 Melodious Jay-Thrush (*Leucodioptron canorum*). Deposited.
2 Macaque Monkeys (*Macacus cynomolgus*), ♂ ♀. Presented by Hugh H. Collis, Esq.

Sept. 2. 1 Raven (*Corvus corax*). Presented by W. Weekes, Esq.
8 Amherst's Pheasants (*Thaumalea amherstiæ*). Bred in the Menagerie.
6 Ring-necked Pheasants (*Phasianus torquatus*). Bred in the Menagerie.
2 Japanese Pheasants (*Phasianus versicolor*). Bred in the Menagerie.
1 Temminck's Tragopan (*Ceriornis temmincki*). Bred in the Menagerie.
4. 1 White-tailed Sea-Eagle (*Haliaëtus albicilla*). Deposited.
5. 1 Emu (*Dromæus novæ-hollandiæ*). Presented by C. W. Williams, Esq.
2 Olive-brown Snakes (*Phrynonax fasciatus*). From Trinidad. Presented by R. R. Mole, Esq.
6. 1 Bonnet-Monkey (*Macacus sinicus*), ♀. Presented by Mrs. Ball.
1 Royal Python (*Python regius*). Presented by C. H. Harley-Moseley, Esq.
1 Common Chameleon (*Chamæleon vulgaris*). Presented by Mr. C. Sampson.
7. 2 Diamond Snakes (*Morelia spilotes*). Deposited.
9. 1 Rhesus Monkey (*Macacus rhesus*), ♂. Presented by Miss E. S. Cooper.
1 Beautiful Grass-Finch (*Poephila mirabilis*), ♂. Presented by Gerard O'Shea, Esq.
1 Brazilian Tortoise (*Testudo tabulata*), ♀. Deposited.
11. 1 Wapiti Deer (*Cervus canadensis*), ♂. Born in the Menagerie.
12. 2 Triangular-spotted Pigeons (*Columba guinea*). Bred in the Menagerie.
1 Spotted Pigeon (*Columba maculosa*). Bred in the Menagerie.
2 Crested Pigeons (*Ocyphaps lophotes*). Bred in the Menagerie.
2 Half-collared Doves (*Turtur semitorquatus*). Bred in the Menagerie.
2 Vinaceous Doves (*Turtur vinaceus*). Bred in the Menagerie.
14. 1 Smith's Dwarf Lemur (*Microcebus smithi*). Presented by Miss Ruby Woolcott.
1 Yellow-fronted Amazon (*Chrysotis ochrocephala*). Presented by W. Page, Esq.
3 Common Boas (*Boa constrictor*). Purchased.
16. 1 Brown Capuchin (*Cebus fatuellus*). Deposited.
17. 1 Bonnet-Monkey (*Macacus sinicus*), ♀. Presented by Miss Larkin.
1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by W. Aldridge, Esq.
2 Egyptian Trionyx (*Trionyx niloticus*). Presented by Mr. J. J. Pinnock.

Sept. 18. 1 Smooth Snake (*Coronella lævis*). Presented by G. J. S. Warner, Esq.
1 Common Viper (*Vipera berus*). Presented by G. J. S. Warner, Esq.
19. 1 Two-toed Sloth (*Cholopus didactylus*). Purchased.
1 Yellow-naped Amazon (*Chrysotis auripalliata*). Purchased.
2 Vulpine Phalangers (*Phalangista vulpina*), ♂ ♀. Presented by F. J. Horniman, Esq., M.P., F.Z.S.
1 Magpie (*Pica caudata*). Presented by H. E. Blandford, Esq., M.A., M.P.
20. 1 Monkey (*Cercopithecus*, sp. inc.), ♂. From British East Africa. Presented by Miss Pigott.
1 Purple-faced Monkey (*Semnopithecus leucoprymnus*). Presented by Mrs. Griffith.
1 Orange-cheeked Amazon (*Chrysotis autumnalis*). Deposited.
21. 1 Martinique Gallinule (*Ionornis martinicus?*). Presented by Mr. H. W. Power.
1 Condor Vulture (*Sarcorhamphus gryphus*). Presented by Mrs. Weigall.
23. 1 Piping Guan (*Pipile cumanensis*). Deposited.
4 Green Lizards (*Lacerta viridis*). Presented by C. W. Tytheridge, Esq.
3 Wall-Lizards (*Lacerta muralis*). Presented by C. W. Tytheridge, Esq.
24. 1 Bonnet-Monkey (*Macacus sinicus*), ♀. Presented by Thos. Mackenzie, Esq.
25. 2 Laughing Kingfishers (*Dacelo gigantea*). Deposited.
27. 1 Chimpanzee (*Anthropopithecus troglodytes*), ♂. Presented by Capt. G. C. Denton, C.M.G.
1 Common Seal (*Phoca vitulina*). Purchased.
28. 1 Bonnet-Monkey (*Macacus sinicus*), ♀. Presented by Messrs. Davies & Sons.
30. 1 White-tailed Ichneumon (*Herpestes albicauda*). From Natal. Presented by W. Champion, Esq.
2 Blotched Genets (*Genetta tigrina*). From Natal. Presented by W. Champion, Esq.
1 Passerine Parrakeet (*Psittacula passerina*). Deposited.

Oct. 1. 2 Norwegian Lemmings (*Myodes lemmus*). Presented by Mrs. Haig Thomas.
2. 1 Cape Hyrax (*Hyrax capensis*). Presented by J. E. Matcham, Esq.
2 Suricates (*Suricata tetradactyla*). Presented by J. E. Matcham, Esq.
3. 1 Rhesus Monkey (*Macacus rhesus*), ♂. Presented by H. Small, Esq.
1 Passerine Parrakeet (*Psittacula passerina*). Presented by R. Norton, Esq.
1 Silky Cow-bird (*Molothrus bonariensis*). Presented by R. Norton, Esq.
1 Red-crested Cardinal (*Paroaria cucullata*). Presented by R. Norton, Esq.
4. 1 Black Ape (*Cynopithecus niger*). Presented by Sir Frank Greswolde Williams.
1 Tuberculated Iguana (*Iguana tuberculata*). Deposited.
2 Common Teguexins (*Tupinambis teguexin*). Deposited.

Oct. 4. 1 Bonnet-Monkey (*Macacus sinicus*), ♀. Presented by Mrs. Lionel Smith.
1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by Mrs. Lionel Smith.
5. 2 Common Kingfishers (*Alcedo ispida*). Presented by J. A. Clark, Esq.
7. 1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by the Rev. Sidney Vatcher.
1 Rose-Hill Parrakeet (*Platycercus eximius*). Deposited.
4 Rhomb-marked Snakes (*Psammophylax rhombeatus*).
3 Crossed Snakes (*Psammophis crucifer*).
2 Rough-keeled Snakes (*Dasypeltis scabra*).
1 Smooth-bellied Snake (*Homalosoma lutrix*).
1 Robben-Island Snake (*Coronella phocarum*).
From Port Elizabeth, S. Africa. Presented by J. E. Matcham, Esq.
8. 1 Bonnet-Monkey (*Macacus sinicus*), ♀. Deposited.
3 Prevost's Squirrels (*Sciurus prevosti*). Purchased.
1 Crested Porcupine (*Hystrix cristata*). Received in Exchange.
9. 2 Beautiful Grass-Finches (*Poëphila mirabilis*). Purchased.
10. 3 Common Rheas (*Rhea americana*), ♂ et 2 juv. Presented by Robert Günther, Esq.
12. 1 Yellow Baboon (*Cynocephalus babouin*), ♀. Deposited.
14. 3 Blackcaps (*Sylvia atricapilla*). Presented by Mr. Poynter.
1 Nightingale (*Daulias luscinia*). Presented by Mr. Poynter.
1 Wall-Lizard (*Lacerta muralis*). Presented by A. M. Amster, Esq.
15. 1 Dwarf Chameleon (*Chamæleon pumilis*). Presented by Mrs. S. Jackson.
16. 2 Masked Parrakeets (*Pyrrhulopsis personata*). Presented by the Hon. Walter Rothschild, F.Z.S.
1 Blue-and-Yellow Macaw (*Ara ararauna*). Presented by the Hon. Walter Rothschild, F.Z.S.
1 Peregrine Falcon (*Falco peregrinus anatum*). Presented by the Hon. Walter Rothschild, F.Z.S.
1 Antarctic Skua (*Stercorarius antarcticus*). Presented by the Hon. Walter Rothschild, F.Z.S.
1 Night-Heron (*Nycticorax griseus*). Presented by the Hon. Walter Rothschild, F.Z.S.
1 Spotted Eagle (*Aquila clanga*). Deposited.
3 Weka Rails (*Ocydromus australis*). Deposited.
4 Tuatera Lizards (*Sphenodon punctatus*). Deposited.
2 Senegal Touracous (*Corythaix persa*). Presented by Mr. I. J. Roberts.
17. 1 Polar Bear (*Ursus maritimus*), ♂. From Spitzbergen. Presented by Arnold Pike, Esq., F.Z.S.
2 Western Boas (*Boa occidentalis*). From Paraguay. Purchased.
4 Knots (*Tringa canutus*). Purchased.
2 Bar-tailed Godwits (*Limosa lapponica*). Purchased.
2 Peewits (*Vanellus cristatus*). Purchased.
1 Curlew (*Numenius arquatus*). Purchased.
1 Spotted Redshank (*Totanus fuscus*). Purchased.
2 Common Terns (*Sterna hirundo*). Purchased.
18. 1 Rhesus Monkey (*Macacus rhesus*), ♀. Presented by Mrs. Vernon Biden.

Oct. 18. 1 Mozambique Monkey (*Cercopithecus pygerythrus*), ♀. Presented by E. Dyer, Esq.
1 Smith's Dwarf Lemur (*Microcebus smithi*). Presented by E. Dyer, Esq.
2 Grisons (*Galictis vittata*). Purchased.
1 Coypu (*Myopotamus coypus*). Purchased.
1 Southern Fruit-Pigeon (*Crocopus chlorogaster*). Deposited.
19. 2 Squirrel Monkeys (*Chrysothrix sciurea*). Deposited.
21. 2 Rufescent Snakes (*Leptodira rufescens*). Presented by J. E. Matcham, Esq.
1 Cape Viper (*Causus rhombeatus*). Presented by J. E. Matcham, Esq.
22. 2 Hybrid Wigeon (between *Mareca penelope* and *Anas boschas*), ♂ ♀. Presented by Wellesley Taylor, Esq.
23. 1 Brown Capuchin (*Cebus fatuellus*). Presented by Sir Egbert Sebright, Bt.
2 Hunter's Spiny Mice (*Acomys hunteri*). Born in the Menagerie.
1 King Parrot (*Aprosmictus scapulatus*). Presented by George Cawson, Esq.
1 Ortolan Bunting (*Emberiza hortulana*). Presented by H. C. Martin, Esq.
26. 1 Great Kangaroo (*Macropus giganteus*), ♀. Deposited.
2 White Storks (*Ciconia alba*). Presented by Sir Charles Payne, Bt.
28. 1 Red-faced Spider Monkey (*Ateles paniscus*). Deposited.
1 Common Boa (*Boa constrictor*). Presented by F. J. Mitchell, Esq.
29. 1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by Mrs. Jackson.
30. 1 Brown Capuchin (*Cebus fatuellus*). Deposited.
3 Red-backed Pelicans (*Pelecanus rufescens*). From the Tana River, E. Africa. Presented by T. E. C. Remington, Esq.
31. 2 Black-tailed Flower-birds (*Anthornis melanura*). Purchased.
2 Silver Pheasants (*Euplocamus nycthemerus*), 2 ♀. Purchased.
1 Common Chameleon (*Chamæleon vulgaris*). Presented by Mr. J. Adams, Jun.

Nov. 1. 2 Verticillated Geckos (*Gecco verticillatus*). Presented by C. H. Champion, Esq.
2. 1 Whimbrel (*Numenius phæopus*). Presented by Messrs. F. C. & E. B. Mason.
4. 1 Common Wombat (*Phascolomys wombat*), ♀. Deposited.
5. 1 Crossed Snake (*Psammophis crucifer*). Presented by J. E. Matcham, Esq.
2 Ring-hals Snakes (*Sepedon hæmachates*). Presented by J. E. Matcham, Esq.
1 Hoary Snake (*Coronella cana*). Presented by J. E. Matcham, Esq.
2 Pennant's Parrakeets (*Platycercus pennanti*). Purchased.
6. 1 White-backed Piping-Crow (*Gymnorhina leuconota*). Deposited.
7. 1 Western Slender-billed Cockatoo (*Licmetis pastinator*). Presented by Mrs. Halford Stephens.
8. 1 Red Kangaroo (*Macropus rufus*), ♂. Born in the Menagerie.

Nov. 8. 1 Rufous Bat-Kangaroo (*Hypsiprymnus rufescens*), ♀. Born in the Menagerie.

11. 1 Black-faced Spider-Monkey (*Ateles ater*). Purchased.

8 Great Tits (*Parus major*). Presented by Mr. Brunsden.

12. 1 Blotched Genet (*Genetta tigrina*). Presented by J. E. Matcham, Esq.

2 Crossed Snakes (*Psammophis crucifer*). Presented by J. E. Matcham, Esq.

1 Smooth-bellied Snake (*Homalsoma lutrix*). Presented by J. E. Matcham, Esq.

1 Rough-keeled Snake (*Dasypeltis scabra*). Presented by J. E. Matcham, Esq.

1 Many-spotted Snake (*Coronella multimaculata*). Presented by J. E. Matcham, Esq.

1 Hygian Snake (*Elaps hygiæ*). Presented by J. E. Matcham, Esq.

15. 2 Lions (*Felis leo*), ♂ ♀. Deposited.

16. 1 Puffin (*Fratercula arctica*). Presented by Dr. J. B. Johnson.

18. 3 Poë Honey-eaters (*Prosthemadera novæ-zealandiæ*). Presented by Morton Campbell, Esq., F.Z.S.

1 Poë Honey-eater (*Prosthemadera novæ-zealandiæ*). Deposited.

19. 1 Kittiwake (*Rissa tridactyla*). Presented by Walter Bullers, Jr., Esq.

1 Four-lined Snake (*Coluber quadrilineatus*). Presented by Capt. Allen Keys.

20. 1 Bonnet-Monkey (*Macacus sinicus*), ♂. Presented by V. Roger, Esq.

23. 1 Smooth-headed Capuchin (*Cebus monachus*), ♀. Presented by Major F. A. White.

1 Bearded Lizard (*Amphibolurus barbatus*). Presented by Frederick Aflalo, Esq.

1 Diamond Snake (*Morelia spilotes*). Presented by Frederick Aflalo, Esq.

25. 2 Barbary Wild Sheep (*Ovis tragelaphus*), 2 ♂. Deposited.

1 Great Northern Diver (*Colymbus glacialis*). Purchased.

1 White-backed Piping-Crow (*Gymnorhina leuconota*). Presented by Percy A. Gore, Esq.

27. 1 White-headed Sea-Eagle (*Haliaëtus leucocephalus*). Presented by Curzon Howe, Esq.

1 Bahama Duck (*Dafila bahamensis*). Purchased.

4 Green-winged Doves (*Chalcophaps indica*). Purchased.

12 Snow-Buntings (*Plectrophanes nivalis*). Purchased.

2 Blood-breasted Pigeons (*Phlogœnas cruentata*). Presented by Capt. Hervey.

28. 1 Chough (*Pyrrhocorax graculus*). Presented by Gerald Strickland, Esq.

4 Dunlins (*Tringa alpina*). Purchased.

1 Grey Plover (*Squatarola helvetica*). Purchased.

1 Golden Plover (*Charadrius pluvialis*). Purchased.

2 Greater Sulphur-crested Cockatoos (*Cacatua galerita*). Presented by Mrs. Morgan.

1 Crimson-winged Parrakeet (*Aprosmictus erythropterus*). Presented by Mrs. Morgan.

29. 1 Dorcas Goat (*Capra dorcas*), ♂. From the Island of Guira, Greece. Purchased. See P. Z. S. 1895, p. 827.

2 Bearded Vultures (*Gypaëtus barbatus*). Purchased.

Dec. 2. 2 Tufted Umbres (*Scopus umbretta*). From Bechuanaland, South Africa. Deposited.

1 Chestnut-breasted Finch (*Donacola castaneothorax*). Presented by A. Rowney, Esq.

3. 1 Black Swan (*Cygnus atratus*), ♂. Deposited by H.R.H. The Prince of Wales.

4. 1 Arabian Baboon (*Cynocephalus hamadryas*), ♀. Presented by Mrs. Locke King.

1 Hardwicke's Mastigure (*Uromastix hardwicki*). Presented by W. Allen, Esq.

5. 4 Cockateels (*Calopsitta novæ-hollandiæ*). Presented by Thomas J. Mann, Esq.

1 Many-coloured Parrakeet (*Psephotus multicolor*). Presented by Thomas J. Mann, Esq.

1 Rose-Hill Parrakeet (*Platycerus eximius*). Presented by Thomas J. Mann, Esq.

1 Green-headed Tanager (*Calliste tricolor*). Purchased.

6. 1 Black-necked Stilt Plover (*Himantopus nigricollis*, jr.). Purchased.

2 Red-and-Blue Macaws (*Ara macao*). Presented by A. J. Chalmers, Esq.

5 Saffron Finches (*Sycalis flaveola*), 2 ♂, 3 ♀. Presented by A. J. Chalmers, Esq.

2 Pileated Song-Sparrows (*Zonotrichia pileata*). Presented by A. J. Chalmers, Esq.

1 Guttural Finch (*Spermophila gutturalis*), ♂. Presented by A. J. Chalmers, Esq.

1 White-throated Finch (*Spermophila albogularis*). Presented by A. J. Chalmers, Esq.

1 Plumbeous Finch (*Spermophila plumbea*). Presented by A. J. Chalmers, Esq.

1 Black-banded Finch (*Spermophila torqueola*), ♂. Presented by A. J. Chalmers, Esq.

1 Brambling (*Fringilla montifringilla*), ♂. Presented by A. J. Chalmers, Esq.

1 Greenfinch (*Ligurinus chloris*), ♂. Presented by A. J. Chalmers, Esq.

1 Black-throated Siskin (*Chrysomitris magellanica*), ♂. Presented by A. J. Chalmers, Esq.

7. 1 Black-necked Stilt Plover (*Himantopus nigricollis*, jr.). Purchased.

1 Chinese Red-vented Bulbul (*Pycnonotus atricapillus*). Presented by the Hon. Miss E. Dillon.

9. 2 Red-headed Pochards (*Fuligula ferina*), 2 ♂. Purchased.

1 Reeves's Terrapin (*Clemmys reevesi unicolor*). Purchased.

1 Hoary Snake (*Coronella cana*). Presented by J. E. Matcham, Esq.

10. 1 Macaque Monkey (*Macacus cynomolgus*), ♂. Deposited.

1 Leopard Tortoise (*Testudo pardalis*). Deposited.

9 Long-eared Sun-Fish (*Lepomis auritus*). Purchased.

5 Rock Bass (*Ambloplites rupestris*). Purchased.

11. 1 Black-necked Stilt Plover (*Himantopus nigricollis*). Purchased.

3 American Jabirus (*Mycteria americana*). From the Island of Marajo, N. Brazil. Presented by H. A. Astlett, Esq.

12. 1 Moor Macaque (*Macacus maurus*), ♀. Presented by Granville Bantock, Esq.

Dec. 12. 1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by Charles Henderson, Esq.

14. 1 Spotted Eagle-Owl (*Bubo maculosus*, jr.). From East Pondoland, E. Africa. Presented by R. W. Murray, Esq.

1 Woodcock (*Scolopax rusticula*). Presented by Charles Smoothy, Esq.

2 Alligators (*Alligator mississipiensis*). Presented by Mr. J. Palmer.

6 Catfish (*Amiurus catus*). Purchased.

17. 1 Common Badger (*Meles taxus*). Presented by Thos. B. Place, Esq.

1 Ornamental Lorikeet (*Trichoglossus ornatus*). Purchased.

1 Forsten's Lorikeet (*Trichoglossus forsteni*). Purchased.

18. 1 Burchell's Zebra (*Equus burchelli*), ♀. Presented by the Hon. Walter Rothschild, F.Z.S.

1 Nilotic Monitor (*Varanus niloticus*). Deposited.

1 Anomalous Snake (*Coronella anomala*). Presented by Frank Summers, Esq.

19. 1 Forsten's Lorikeet (*Trichoglossus forsteni*). Purchased.

1 Ornamental Lorikeet (*Trichoglossus ornatus*). Purchased.

2 Hoary Snakes (*Coronella cana*). Presented by J. E. Matcham, Esq.

2 Puff-Adders (*Vipera arietans*). Presented by J. E. Matcham, Esq.

20. 1 Rough Fox (*Canis rudis*). Presented by Capt. J. Ernst.

1 Blue-and-Yellow Macaw (*Ara ararauna*). Presented by Mrs. Alec Tweedie.

1 Cactus Conure (*Conurus cactorum*). Received in Exchange.

23. 2 Red-sided Tits (*Parus varius*). Purchased.

1 Golden Eagle (*Aquila chrysaëtus*). Presented by Osgood H. Mackenzie, Esq.

24. 1 Southern River-Hog (*Potamochœrus africanus*), ♂. From the Zanzibar Coast. Presented by Henry F. C. Festing, Esq., Commander R.N.

27. 1 White-crowned Mangabey (*Cercocebus æthiops*), ♂. Deposited.

1 Green Monkey (*Cercopithecus callitrichus*), ♂. Deposited.

30. 2 Bonnet-Monkeys (*Macacus sinicus*). Presented by Sir F. Greswolde Williams.

1 Roofed Terrapin (*Hydromedusa tectifera*). Purchased.

2 Leopard Tortoises (*Testudo pardalis*). Presented by J. E. Matcham, Esq.

2 Puff-Adders (*Vipera arietans*). Presented by J. E. Matcham, Esq.

1 Infernal Snake (*Boodon infernalis*). Presented by J. E. Matcham, Esq.

31. 1 Snow-Bunting (*Plectrophanes nivalis*). Presented by J. E. Harting, Esq., F.Z.S.

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II. ,, ,, ,, March and April, on August 1st.
III. ,, ,, ,, May and June, on October 1st.
IV. ,, ,, ,, November an[illegible]ber, on April 1st.